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Fishing Services Catalog

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Introduction

When downhole problems delay operations or interrupt production, costs increase and profitability suffers. Baker Hughes offers an extensive portfolio of fishing products and services to help restore and ensure maximum production—quickly and efficiently. Our conventional fishing, casing exit, and wellbore cleanup solutions are tailored for each challenge, helping operators reduce costs maintain productive reservoirs for the life of their wells.

Conventional fishing

Our portfolio of conventional fishing technologies for cased and open hole operations includes the industry's largest selection of fishing, milling, cutting, and specialty tools available. These field-proven tools and systems are designed to remove wellbore obstructions safely and efficiently so you can maximize production and minimize downtime. From specialty carbide inserts that enhance penetration rates and mill life, to our Sentio smart intervention service that provides real-time data to help optimize operations, we have the time-tested equipment and broad experience to meet your fishing challenge.

Casing exit systems

Our field-proven casing exit systems enable one-trip, full-gauge window cutting in a wide range of formations and hole conditions, ensuring operators can reach previously uneconomical reserves and bypass trouble. With more than 5,000 successful runs, our wide selection of anchors, window mills, retrieving tools, section mills, underreamers, whipstocks, and accessory tools can overcome any challenge, no matter how complex. With Baker Hughes casing exit systems, you can access all areas of your payzone quickly, efficiently, and with minimum risk.

Wellbore Cleanup

Up to 30% of NPT experienced during completions is a result of debris left in the wellbore. Baker Hughes wellbore cleanup systems significantly reduce cost and completion risk by effectively cleaning casing and removing debris before the well is completed to ensure trouble-free operations and maximum reservoir return. Our X-Treme Clean™ line of mechanical tools includes reliable, modular systems organized into different tiers of products and services to match your application, whether onshore or in a complex deepwater well.

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Sentio Smart Intervention Services

Sentio Smart Intervention Services

Sentio Smart Intervention Services

Sentio Smart Intervention Services

Reduce the risk of NPT and optimize your wellbore intervention

Baker Hughes Sentio™ smart intervention services provide the operator at the surface with real-time data from downhole sensors during pipe-conveyed wellbore intervention operations. The Sentio service offers critical mechanical and dynamic downhole parameters such as weight, torque, bending moment, pressure, and vibrations, allowing operators to make on-the-fly adjustments to optimize their operations. The data are displayed at the rig floor and may also be sent offsite to the customer for immediate review, whether at their office or at a Baker Hughes BEACON™ collaboration center.

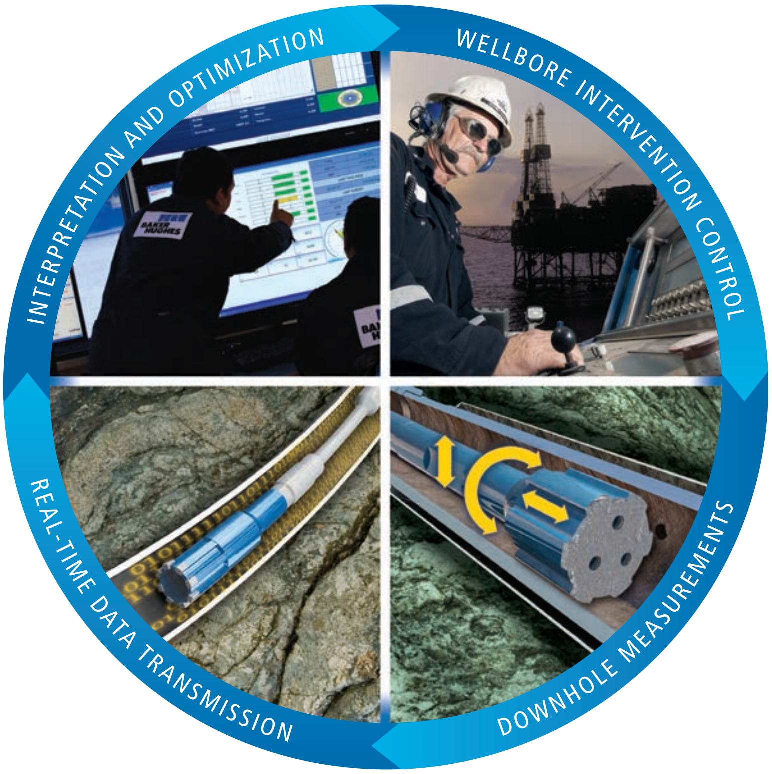
In very deep wells, horizontal wells, or highly deviated wells, the surface gauges that operators traditionally rely on become inaccurate. Friction and gravity over the length of the drillpipe will change how forces at the bottom of the hole are transferred to the surface gauges, making an accurate gauge reading impossible. The Sentio service solves this problem by placing gauges at the end of the toolstring, giving the operator a clear indicator of what is happening downhole.

Sentio smart intervention service combines wellbore intervention tools such as mills, fishing tools, or wellbore cleanup tools with logging-while-drilling technology. The full service is composed of

- Two Baker Hughes operators at surface
- Telemetry system to send and receive data
- Downhole sensor system
- Wellbore intervention tools

The Sentio service provides the operator with a sense of touch that is impossible to obtain with surface gauges alone, and allows for surgical precision in carrying out the wellbore intervention job while reducing the risk of nonproductive time (NPT). The Sentio service can increase an operator's success rate under the most trying downhole conditions.

Contact your Baker Hughes representative or visit www.bakerhughes.com/sentioservices to learn how to reduce your risk of NPT and optimize the well intervention process with real-time downhole data from our Sentio smart intervention service.


INTERPRETATION AND OPTIMIZATION
WELLBORE INTERVENTION CONTROL
DOWNHOLE MEASUREMENTS
REAL-TIME DATA TRANSMISSION

Sentio Smart Intervention Services

Applications

- Section, packer, and junk milling
- Whipstock exits
- Packer- or well-barrier setting and retrieval
- Fishing or object retrieval
- Wellbore cleanup
- Torque-and-drag data collection

Features and Benefits

- Real-time downhole sensor data
  - Increases job efficiency through the immediate detection and correction of issues
  - Reduces uncertainty and mitigates risk of NPT
- Tension/compression readings during object retrieval
  - Ensure tools are pulled out of hole (POOH) only after objective is confirmed
  - Help avoid NPT with accurate overpull data
  - Can confirm jarring occurred
- Tension/compression readings during wellbore cleanup
  - Help operators monitor progress of scraping operations
- Torque, compression, equivalent circulating density, and RPM readings during milling and whipstock exits
  - Improve milling efficiency
  - Help with early detection of packoff
  - Reduce the risk of damaging mills leading to early POOH
- Torque-and-tension log
  - Allows operators to identify tight spots and preserve casing integrity
  - Improves torque-and-drag models

Notes

Internal and External Cutting Tools

BG Outside Cutter

HERCULES Multistring Cutter

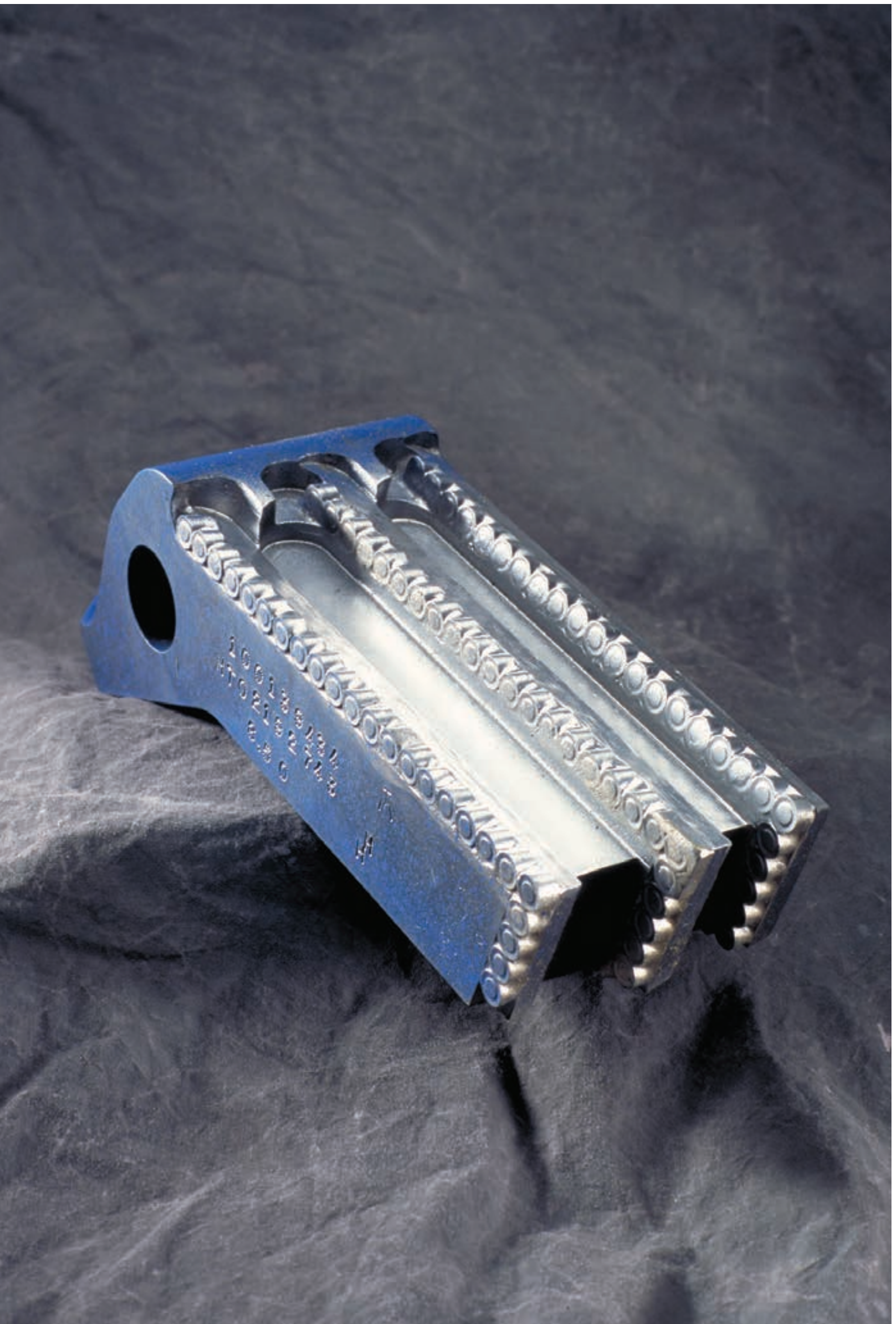
Inside Hydraulic Cutter

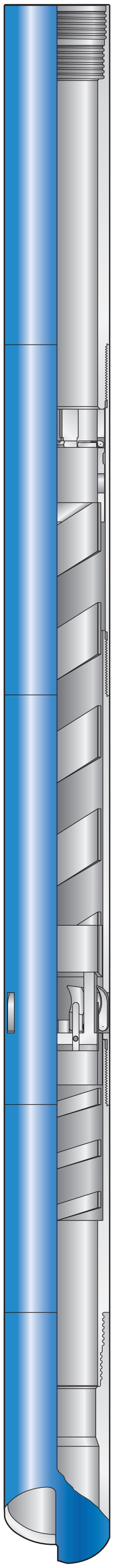
Inside Mechanical Casing Cutter

Multistring Cutter

Outside Shear Pin Cutter

Standard and Washover Outside Cutters





BG outside cutter
Product family no. H17017

BG Outside Cutter

Eliminate broken knives and missed cuts during fishing

The Baker Hughes BG outside cutter is an automatic, spring-fed cutter that provides fast and reliable external cutting and recovery of tubing and drillpipe in a wide variety of pipe hardness and tool joint configurations. It applies a predetermined and controlled amount of pressure on the knives, eliminating the problem of broken knives and missed cuts.

The BG cutter ensures a cut even if the strain pulled on the pipe is above or below the desired amount. It cuts tubing with coiled tubing inside and recovers both strings.

The predetermined pressure compensates for any miscalculations or faulty readings regarding the amount of strain pulled on the fish, eliminating knife breakage. This feature makes it ideal for high-angle and horizontal wells.

The pipe-latching assembly can be furnished to catch under the couplings or collars of square-shouldered pipe and under the upset of integral joint pipe. The ability to adjust the amount of force on the knives allows pipe of varying degrees of hardness to be cut quickly and reliably.

The BG outside cutter is run with enough washpipe to cover the fish and the workstring is elevated until the cutter is at proper cutting depth. In a very high-angle hole, we recommend running a shoe with the smallest inside diameter (ID) as possible and running an extension or joint of washpipe below the cutter to help stabilize it. The pipe is then rotated, cutting with the weight of the workstring and the fish to be cut. When the cut is complete, the cutter and fish can be pulled out of hole and the fish stripped out of the washpipe. This cut will be smooth on the outside diameter of the pipe, so engaging externally and running wireline requires no dressing off.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how to eliminate broken knives and missed cuts during fishing using our BG outside cutter.

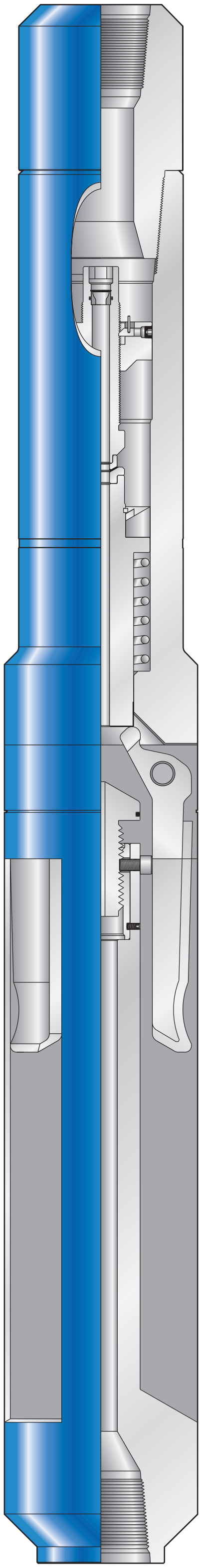
Applications

- Cut and recover tubing and drillpipe

Features and Benefits

- Fewer moving parts
  - Eliminates failure points
- Cuts pipe in fewer than five minutes
  - Saves time and expense
- Large ID
  - Allows cutter to easily pass over gas lift mandrels, ball valves, and other obstacles
- Predetermined and controlled pressure
  - Eliminates knife breakage when swallowing fish
- Can rotate while washing over fish
  - Increases flexibility

Internal and External Cutting Tools



HERCULES™ multistring cutter
Product family no. H17009

HERCULES Multistring Cutter

Cut through multiple or large-diameter strings of casing more efficiently

The Baker Hughes HERCULES™ multistring cutter is a hydraulically operated, solid-body tool used to cut through multiple strings of casing or large-diameter strings quickly and safely. The three knives of the HERCULES multistring cutter are normally dressed with either SUPERLOY™ high-strength material or METAL MUNCHER™ advanced milling technology (AMT™) inserts and are 30% stronger than standard multistring cutters. The HERCULES cutter can be used in any cutting application where rotation and pressure can be applied to the tool.

The HERCULES multistring cutter is hydraulically operated by drilling fluid pressure acting against a piston. The necessary pressure differential is established by the flow rate of the drilling or workover fluid through the indicator nozzle. The nozzle size can be adjusted as necessary to produce a sufficient pressure differential depending on the fluid pump flow rate available.

Standard bit nozzle sizes are used for convenient interchangeability. At sufficient pressure differential, the piston moves against the compression spring and contacts the knife heel, moving the knives into cutting position.

The continued movement of the piston forces the knives to pivot about the knife pins. When the knives are near full extension, the indicator contacts the indicator stop. At this point, drilling fluid begins to flow freely through the indicator, which results in a sudden pressure drop, signaling the operator the knives are fully extended.

In subsea applications, a marine swivel or universal wellhead recovery system is required. When casing repair operations are performed for a slot recovery, safeguards must be taken to ensure the outer casing is not damaged. For this type of operation, the HERCULES multistring cutter can also be mechanically controlled by the positive adjustment screw, which is installed below the knives to limit the maximum knife extension.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes HERCULES multistring cutter helps you effectively cut and retrieve drillpipe.

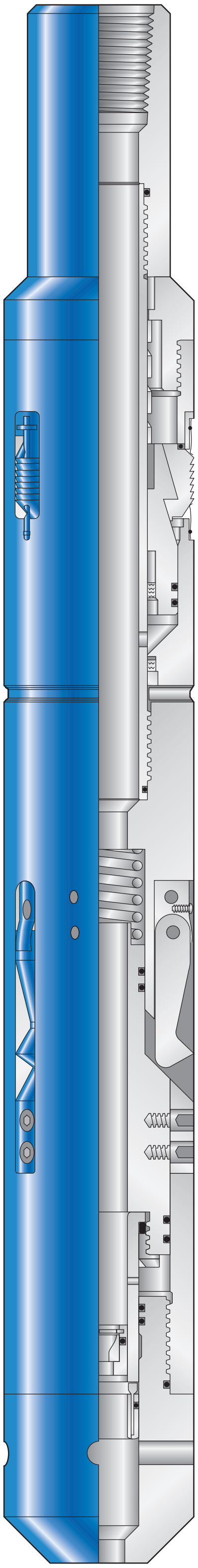
Applications

- Casing repair
- Subsea applications

Features and Benefits

- Solid body design
    - Can withstand extreme shock loads during cutting
- Pressure indicator
    - Can be adjusted without taking the tool apart
    - Saves time and expense
- Positive adjustment screw
    - Can be set for mechanical lock on knives
    - Allows for single-string cuts with minimal contact to the outer string
- Large piston area
    - Reduces amount of surface pressure required to operate cutter
- Knives can easily be changed on rig floor
    - Saves time and expense
- Standard bit nozzle sizes
    - Reduce expense through interchangeability

Internal and External Cutting Tools



Inside hydraulic cutter
Product family no. H17003

Inside Hydraulic Cutter

Cut casing safely with virtually no risk of damage

The Baker Hughes inside hydraulic cutter cuts single strings of casing smoothly and efficiently with hydraulic actuation. It incorporates an indicator that signals through pump pressure when the cut is complete, and has a positive anchor slip assembly to keep the cutter anchored in the casing. Pistons force the slips to firmly anchor the tool before the knives contact the casing, eliminating the chance of damage to the casing. The cutter is manufactured of tool steel, and can be dressed with carbide inserts for enhanced cutting performance. If is also available in different sizes to accommodate different casing sizes.

When the cutter has been run to the desired cutting depth, rotation is initiated and circulation is started. An increase in torque indicates that casing is being cut. When the cut is complete, the control dog moves into a recess in the bottom nut, causing a decrease in pump pressure that indicates the cut is complete. Straight pickup retracts the slips and knives. The inside hydraulic cutter should always be run with a float sub.

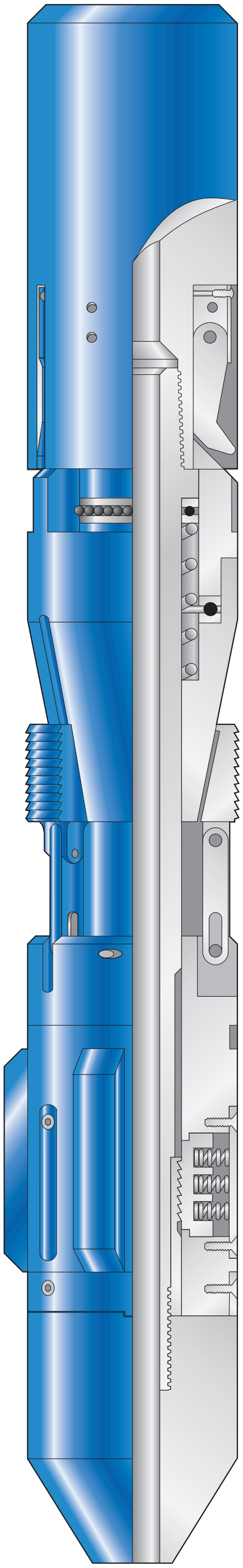
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can cut casing safely with virtually no risk of damage using our inside hydraulic cutter.

Application

- Cut single strings of casing

Features and Benefits

- Positive indication of cut
  - Eliminates risk of casing damage
- Knife design
  - Prevents damage to outer casing when cut is complete
- Positive anchor slip assembly
  - Improves stability
  - Smooths cut
- Easy conversion to different sizes
  - Saves time and expense



Inside mechanical casing cutter
Product family no. H17012

Inside Mechanical Casing Cutter

Cut quickly and easily convert to different casing sizes

The Baker Hughes inside mechanical casing cutter cuts tubing and casing internally. Each cutter consists of a friction assembly used to set the tool in the pipe, a slip assembly for anchoring, and a cutting assembly with tool steel or insert knives. The tools cut quickly and easily convert to alternate casing weights.

The inside mechanical casing cutter is lowered into the hole to the point where the cut is to be made. The tool is rotated to the right and gradually lowered. This action allows the friction block assembly to unscrew from the mandrel, which anchors the tool in the pipe. After the slips are set, the wedge block forces the knives outward until the pipe is cut. When the cut is complete, picking up the workstring then automatically returns the friction assembly to the run-in position. An automatic nut design allows the tool to disengage and reset repeatedly without coming out of the hole.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes inside mechanical casing cutter easily converts to cut different casing sizes.

Applications

- Cut tubing and casing internally

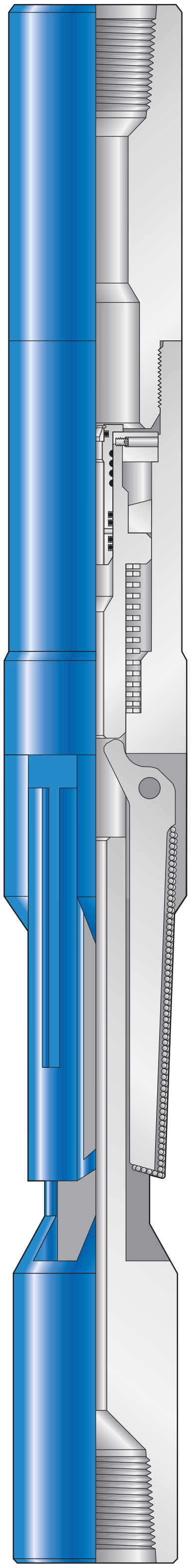
Features and Benefits

- Easy conversion
  - Can cut alternate casing weights
- Automatic nut design
  - Allows tool to disengage and reset repeatedly
- Mechanically operated
  - Requires no hydraulics
- Slip assembly
  - Anchors cutter centrally
  - Ensures precise, smooth cut

Internal and External Cutting Tools

Multistring Cutter

Cut multiple strings of casing and large-diameter strings quickly and safely



Multistring cutter
Product family no. H17008

The Baker Hughes multistring cutter is used to cut through multiple strings of casing or large-diameter strings quickly and safely. Its tempered steel knives are normally dressed with either SUPERLOY™ high-strength material or METAL MUNCHER™ advanced milling technology (AMT™) inserts for superior performance. It is used on both fixed and floating platforms as well as on land rigs.

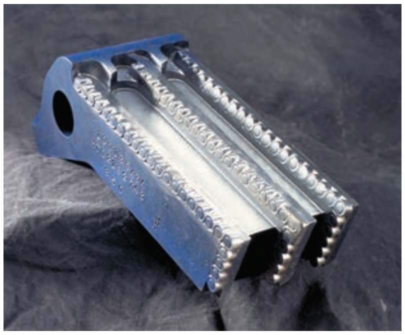
The multistring cutter is hydraulically operated by drilling fluid flowing through an indicator nozzle and activating a piston, which contacts the cutter knives and pivots them into cutting position. The cutter is dressed with knives and run in the well with a stabilizer immediately above and/or below it. When cutting depth is reached, rotation begins. Pump pressure is applied to force the knives against the casing inside diameter. Rotary speed and pump pressure are then increased until the knives have cut through the casing and expanded to their maximum position. A sudden pressure drop and torque decrease indicates the cut has been made.

After the cut is finished, the pumps are shut off and the tool is pulled out of the hole. For floating platform operations, a slack joint or motion compensator, marine swivel, and space-out assembly are required in addition to the stabilizers.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the multistring cutter lets you cut multiple strings of casing and large-diameter strings quickly and safely.

Applications

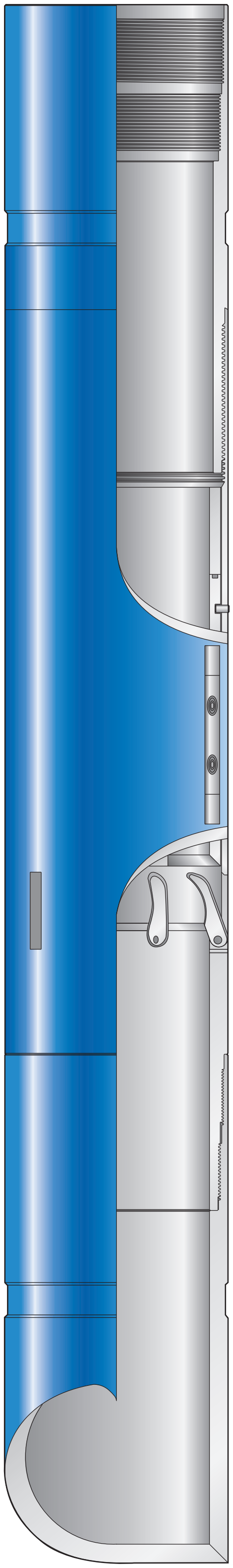
- Cut multiple strings of casing
- Cut large-diameter strings
- Fixed and floating platforms
- Land rigs



Multistring cutter knife with METAL MUNCHER™ AMT™ inserts

Features and Benefits

- Rugged, dependable design
  - Withstands extreme shock loads during cutting
- Cuts multiple strings even when not concentric
  - Handles nonstandard wells
- Knives changeable on rig floor
  - Reduces risk and nonproductive time
- Tempered steel dressable with METAL MUNCHER AMT or SUPERLOY inserts
  - Maximizes cutting power and performance
- Large piston area
  - Reduces amount of surface pump pressure required to operate cutter and expand knives



Outside shear pin cutter
Product family no. H17113

Outside Shear Pin Cutter

Cut tubing or drillpipe when fish OD demands custom-sized cutter

The Baker Hughes mechanically-operated outside shear pin cutter is used to cut and remove tubing or drillpipe from the wellbore. The outside shear pin cutter offers the maximum ratio of fish-outside-diameter (OD) to cutter-OD of any outside cutter. The outside shear pin cutter is meant to be used only when a custom-sized cutter is needed due to fish-OD. The Baker Hughes BG outside cutter, washover outside cutter, or the standard outside cutter are available for more rugged applications.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can use our outside shear pin cutter to effectively cut tubing or drillpipe when the fish OD requires a custom-sized cutter.

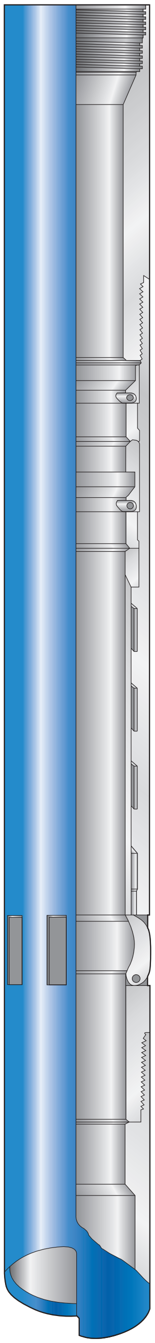
Applications

- Cut and remove tubing or drillpipe
- Operations needing largest ratio of fish-OD to cutter-OD

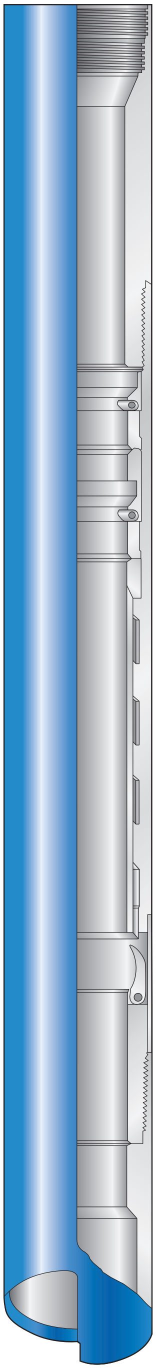
Features and Benefits

- Largest ratio of fish-OD to cutter-OD of any outside cutter
  - Applies when other cutters cannot operate
- Cut is clean and requires no dressing
  - Saves time and expense
- Cut is made mechanically
  - Reduces risk
- Body constructed from AISI 4140 heat-treated alloy steel
  - Improves reliability
- Knives constructed of heat-treated and contour-ground tool steel
  - Maximizes cutting performance

Internal and External Cutting Tools



Standard outside cutter Product family no. H17013



Washover outside cutter Product family no. H17014

Standard and Washover Outside Cutters

Cut casing from the outside and recover tubulars in one trip

The Baker Hughes standard outside cutter and washover outside cutter are mechanically operated cutting tools used to cut and recover tubulars from the outside in one trip. The washover outside cutter has a sleeve around the knife cage that allows circulation to go out the bottom of the washpipe to optimize washover operations. The standard cutter does not have this sleeve and circulation goes out at the knives. Both cutters require the outside of the pipe to be free.

We recommend washing over with a rotary shoe and washpipe before running an outside cutter. After the fish has been washed over, the rotary shoe is replaced with the cutter. After the cutter has passed over the fish, the workstring should not be elevated until the cutter is at the desired cutting depth. After the desired cutting depth is reached, the string should be elevated to locate a collar or tool joint. The string is then lowered to take any load off the knives before cutting.

The tool is operated by pulling the dog assembly up under a collar or tool joint while rotating. The dog assembly forces the wedge block down, which forces the knives in until the cut is complete.

When the cut is complete, the cutter and fish can be pulled out of hole and the fish stripped out of the washpipe. The cut left by the outside cutter will be smooth on the outside diameter and slightly flared on the inside diameter (ID). Engaging externally and running wireline requires no dressing off.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes standard and washover outside cutters can be used to cut casing from the outside and recover tubulars in one trip.

Applications

- Cut and recover tubulars

Features and Benefits

- Knives constructed of heat-treated, contour-ground tool steel
  - Can cut tubulars with plugged ID
  - Maximizes cutting performance
- Cuts clean with no requirement for dressing
  - Saves time and expense
- Cuts mechanically
  - Reduces risk
- Simple design and operation
  - Increases reliability

Internal and External Engagement Tools

Box Tap

Bulldog Overshot

Center Prong and Crankshaft Rope Spear

Hollow Pin Tap

High-Pressure Packoff Assembly

Hydraulic Casing Spear

Itco-Type Bowen Releasing Spear

Kelo Socket Overshot

Pin Tap

Spear Packoff

Spear Stop Sub

TMF Overshot

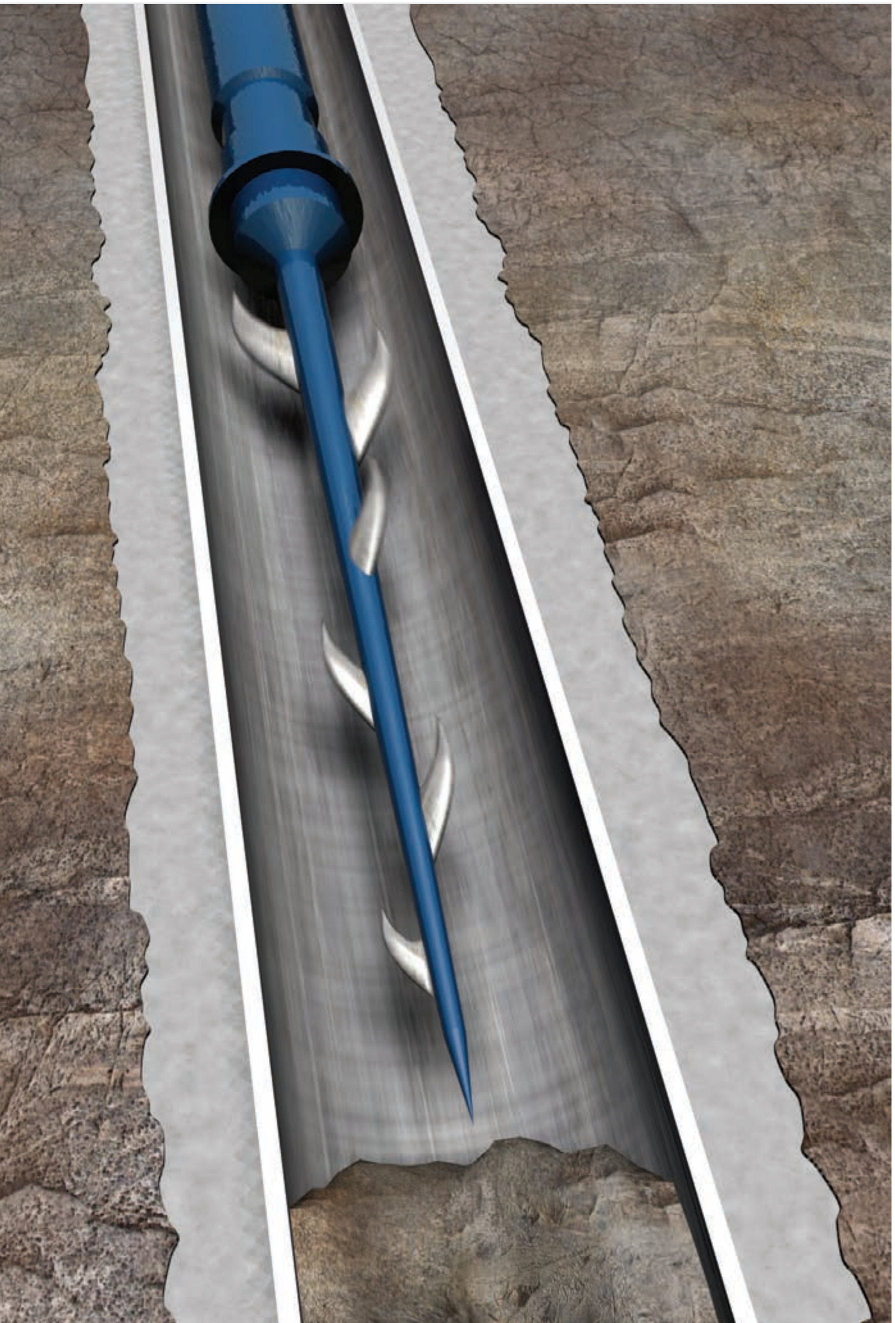
Taper Tap

Series 150 Bowen Releasing and Circulating Overshot

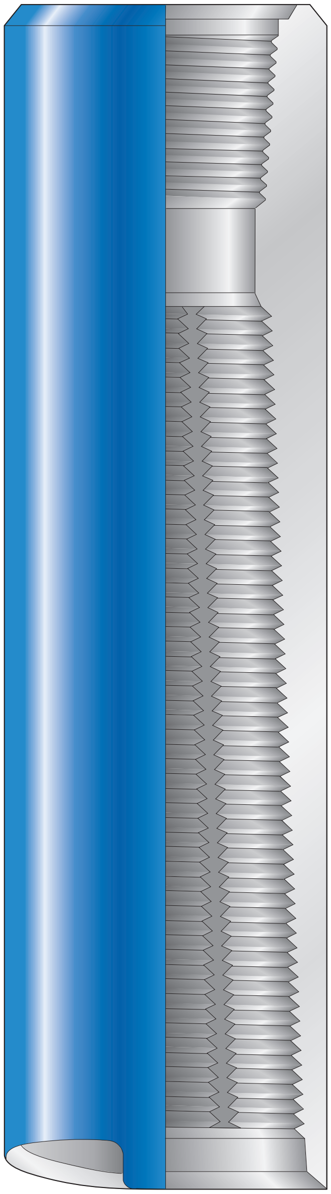
Type B Casing and Tubing Spear

Type D Casing and Tubing Spear

Type E Casing Spear



Internal and External Engagement Tools



Box tap
Product family no. H11099

Box Tap

Engage fish when releasable tools cannot be used

The Baker Hughes box tap engages the outside of a fish when conventional releasing overshot is unfeasible. Like the Baker Hughes taper tap, the box tap cuts threads where no threads are present. Box taps fish out various types of downhole equipment, including tubulars, bridge plugs, and packers. The normal taper of the box tap is ¾ in. per foot, which is the most effective for fishing applications.

The box tap is run into a hole and the top of the fish is lightly tagged. The box tap is then picked up and rotated slowly with free torque in the workstring. While rotating, the box tap is slowly lowered onto the fish until the torque begins to build up rapidly. The setdown weight is increased as the torque increases. When the box tap is firmly seated on the fish, the fish can be retrieved with straight pull (dependent on the fishing scenario).

Taps are nonreleasable and should be run with bumper jars and safety joints. Taps should be used only when releasable engagement-type tools are not an option.

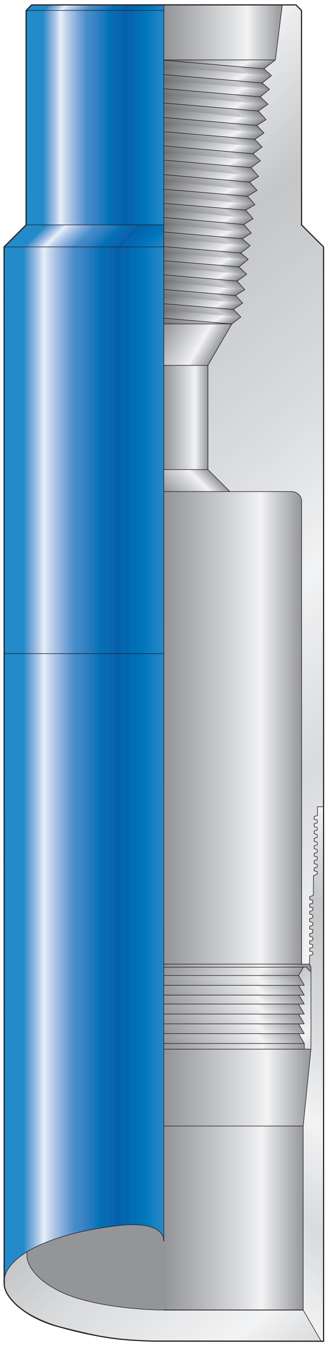
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes box tap engages fish when releasable tools cannot be used.

Applications

- Fishing
- Tapping downhole equipment

Features and Benefits

- Engages the outside of a fish where conventional releasing overshot is unfeasible
  - Addresses cases where other options do not work
- Taps many types of downhole equipment
  - Provides greater flexibility
- ¾-in. taper
  - Works most effectively in fishing applications
- Comprehensive data set
  - Can be used for post-job analysis BHA optimization



Bulldog overshot
Product family no. H11107

Bulldog Overshot

Pick up fish too large to be caught by other methods

The Baker Hughes bulldog overshot is used for straight pickup of fish with outside diameters (ODs) too large to be caught by any other method. It is useful when releasable tools cannot be used. The bulldog overshot's simple design incorporates a C-grapple, and can be manufactured in one or two pieces for added flexibility.

The bulldog overshot is not releasable and has limited tensile and torsion strengths.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes bulldog overshot helps you pick up fish too large to be caught by other methods.

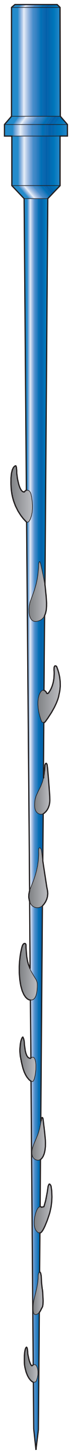
Applications

- Fishing large OD fish

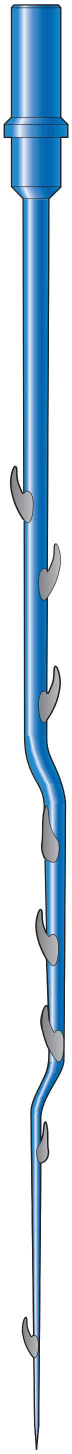
Features and Benefits

- Smallest ratio of fish OD to overshot OD
  - Addresses cases where other options cannot work
- Simple design
  - Eases operation and maintenance
- Can be manufactured in one or two pieces
  - Adds flexibility to fit unique situations

Internal and External Engagement Tools



Center prong
rope spear
Product family no.
H12028



Crankshaft
rope spear
Product family no.
H12229

Center Prong and Crankshaft Rope Spear

Reliably retrieve wireline and wire-rope left downhole

The Baker Hughes center prong rope spear and crankshaft rope spear are reliable and efficient wireline and wire-rope retrieval tools that retrieve all sizes of electric wireline, slick line, braided line, or other types of wire-rope that have been left downhole. The retrieval can be performed even if the wireline or rope is still attached to stuck downhole tools.

The spears can also be used to retrieve control line or electric submersible pump cable left downhole in cased hole or openhole wells. In cased-hole applications, we recommend that a stop always be run above the spear. In openhole wells, we recommend not running a stop.

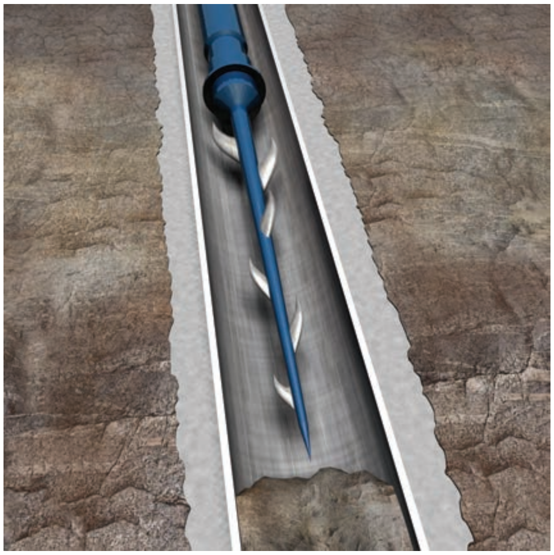
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes center prong rope spear and crankshaft rope spear can help you effectively retrieve wireline and rope from downhole.

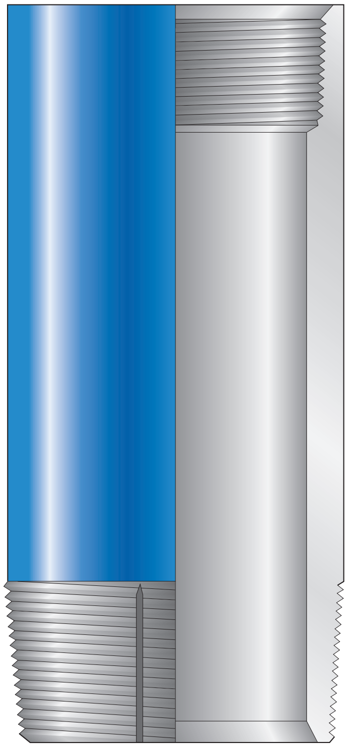
Applications

- Retrieve wireline and wire-rope left downhole
- Retrieve wire or rope stuck to downhole tools

Features and Benefits

- Simple construction
  - Reduces maintenance costs
- Easily customizable
  - Adds flexibility





Hollow pin tap
Product family no. H12101

Hollow Pin Tap

Retrieve fish when washpipe has twisted off over the maximum washover size

The Baker Hughes hollow pin tap is designed for a very specific operation. When a joint of washpipe has twisted off with a fish sticking out of the top, a hollow pin is usually the only solution for engaging the tool. The hollow pin tap, which can be manufactured with any connection, has the same inner diameter as the washpipe connections. This allows washpipe that has twisted off over the maximum washover size to be engaged.

The hollow pin tap is nonreleasable and should be used only when releasing tools are not an option. The hollow pin tap is run into the hole and it lightly tags the top of the fish. Caution must be used going over the fish sticking out of the top of the washpipe. The pin tap is then picked up and rotated slowly, with free torque in the workstring. During rotation, the hollow pin tap is slowly lowered into the fish until the torque begins to build up rapidly. The setdown weight is increased as the torque increases. When the hollow pin tap is firmly seated in the fish, the fish can be retrieved with straight pull (dependent on the fishing scenario).

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn how the Baker Hughes hollow pin tap retrieves a fish when washpipe has twisted off over the maximum washover size.

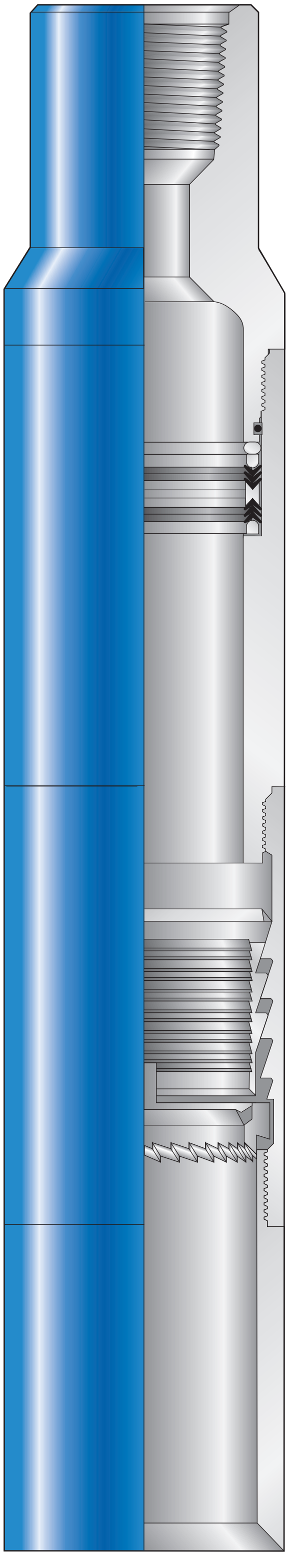
Applications

- Retrieve a fish when washpipe is twisted off with the fish sticking out of the top

Features and Benefits

- Available in all washpipe connections
  - Adds flexibility
- Manufactured from high-quality AISI 4140 material
  - Enhances reliability
- Carburized wickers with high surface hardness
  - Improves performance and durability

Internal and External Engagement Tools



High-pressure packoff assembly
Product family no. H11059

High-Pressure Packoff Assembly

Establish high-pressure circulation downhole to remove blockage and spot releasing fluid

The Baker Hughes high-pressure packoff assembly is an overshot accessory that is used to establish high-pressure circulation down the well to remove blockage and spot releasing fluid. It is also used for tubing patch applications. It is a simple design consisting of the packoff sub with packing and packing retainer rings.

The high-pressure packoff is run between the top sub and the bowl. After a clean fish top has been established, the high-pressure packoff can be run in with the overshot. The fish is engaged after the instructions for the overshot are followed.

After the fish is positively engaged, it is possible to apply two to three times the pressure that can normally be applied to a standard overshot packing. The packing is normally stacked to hold pressure internally and externally.

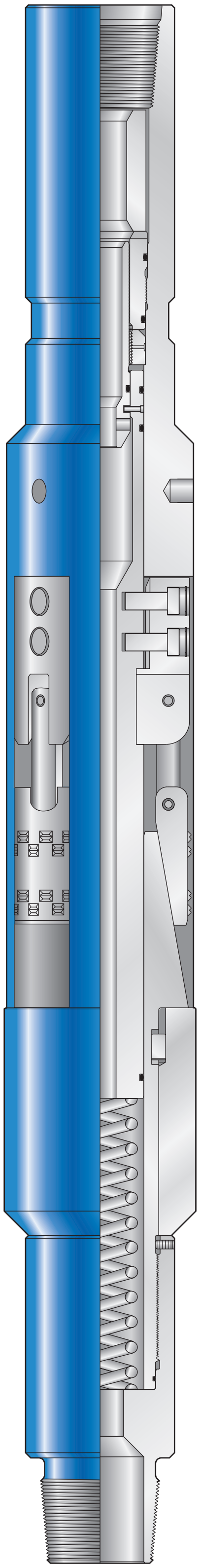
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes high-pressure packoff assemblies establish high-pressure circulation downhole to remove blockage and spot releasing fluid.

Applications

- Establish high-pressure circulation down the well
- Tubing and casing patch applications

Features and Benefits

- Converts standard overshot to a temporary or permanent tubing patch
  - Adds flexibility
- Allows high-pressure circulation to the fish
  - Removes inside diameter blockage and spots releasing fluid
- Superior packing
  - Resists corrosion from downhole fluids
- High-pressure packoff rating
  - Withstands two to three times the pressure of standard overshot packing
- Packoff assembly threads
  - Are compatible with popular overshot bowl and top sub threads



Hydraulic casing spear
Product family no. H12309

Hydraulic Casing Spear

Cut and retrieve casing string in one trip

The Baker Hughes hydraulic casing spear is used to retrieve casing sizes from 9⅝in. to 13⅜in. (244.5 mm to 339.7 mm) and is run above a mechanical or hydraulic inside-casing cutter. It allows cutting and pulling the casing string in one trip. The spear can be rotated inside the casing string without engaging. After the cut is completed, the spear can then be positioned at the desired location inside the casing string. The tool can withstand the most severe downhole environments for casing retrieval.

The spear is dressed to the correct size casing to be engaged. We recommend running the hydraulic spear one joint above the cutter you are using. This prevents needing to strip out of the casing at surface to lay down cutter and accessories.

After the cut is made, the spear is picked up to be positioned at the top of casing string and the restriction plug is dropped into the drillpipe. One minute per 1,000 ft (305 m) is allowed for the restriction plug to seat in the spear. Pressure is brought up slowly to the necessary pressure drop (minimum of 500 psi [34.47 bar]) to set the spear. When the spear is set, the casing is picked up and pulled out of the hole slowly. The joint of pipe is set on top of the spear in rotary and the shear release ball is dropped into the pipe. The kelly or top drive is picked up and screwed into the pipe. The casing is picked up and set in slips and secured. Pressure is increased on the spear to the necessary shear load. After the shear screws are sheared, the spear is released and can be laid down.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes hydraulic casing spear cuts and retrieves casing string in one trip.

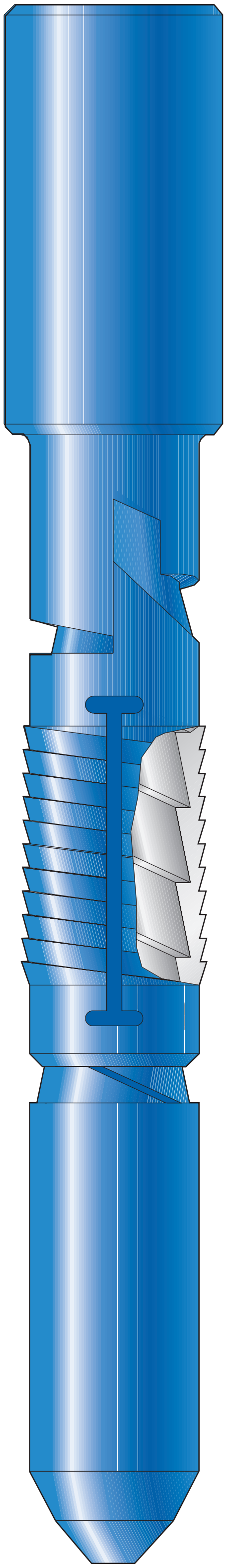
Applications

- Cut and retrieve casing sizes from 9⅝in. to 13⅜in.

Features and Benefits

- Simple construction
  - Eases operation and maintenance
- Slips are retracted inside body
  - Prevents damage to tool or casing when casing is cut
- Bore-through inside diameter
  - Permits circulation to casing cutter
- Dressings for alternate casing sizes
  - Improves flexibility
- Set and released hydraulically
  - Requires no mechanical intervention
- Rugged design
  - Withstands severe downhole environments

Internal and External Engagement Tools



Itco-type Bowen releasing spear
Product family no. H12210

Itco-Type Bowen Releasing Spear

Economically engage, release, and re-engage fish as needed

The Baker Hughes Itco-type Bowen releasing spear provides a dependable, inexpensive, and simple means of engaging a fish internally. The spear ensures positive engagement, easy release from the fish when desired, and easy re-engagement after the spear has been released.

It consists of a mandrel, grapple, release ring, and nut. The mandrel is available in a flush or shoulder type, and mandrel-top connections are furnished to order. The flush type goes into an inside diameter, and the shoulder type bottoms out. The nut can be obtained as a plain bullnose guide or with a pin connection for the attachment of other tools such as a packoff or alignment tool below the spear.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes Itco-type Bowen releasing spear economically engages, releases, and re-engages fish as needed.

Applications

- Engage a fish internally

Features and Benefits

- Easy release mechanism
  - Reduces risk
- Wide range of sizes
  - Increases flexibility
- Rugged manufacture
  - Enhances durability

Kelo Socket Overshot

Recover coiled tubing and small-diameter workstrings without rotation

Baker Hughes kelo socket overshots are simple bulldog overshots used to catch small-diameter workstrings and sucker rods inside casing. They are also used to recover coiled tubing that has parted and remains in the hole.

Before running, the nonreleasable kelo socket is dressed with the correct slip. The tools are tripped in the hole and the socket is lowered over the top of the fish without rotation. If the fish has a flared top, it is dressed off with the SUPERLOY™ dressed guide using right-hand rotation. The rotary is then stopped and the kelo socket is lowered over the fish.

The slip is engaged by picking up on the workstring. The slip, which is pushed up the slip guide, catches the outside diameter of the fish and starts down the slip guide's tapered slot. The more pull, the tighter the slip will grip the fish. This overshot is not releasable after the slip is engaged.

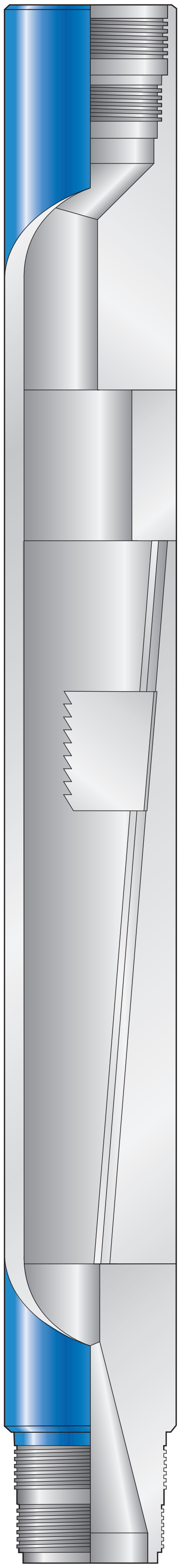
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes kelo socket overshot recovers coiled tubing and small-diameter workstrings without rotation.

Applications

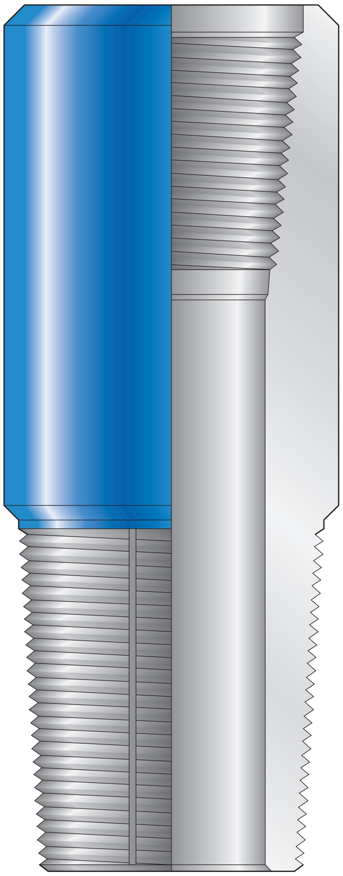
- Retrieve small-diameter workstrings and sucker rods inside casing
- Recover coiled tubing that has parted and is in the hole

Features and Benefits

- Slip is the only moving part
  - Simplifies operation
- Slip rides in a T-slot in the tool and opens and sets without rotation
  - Can be run on non-rotational string
- Optional oversized guides
  - Prevents overshot from missing fish when washing over
- SUPERLOY dressing available
  - Mills offs flared ends or tops of tubing



Kelo socket overshot
Product family no. H11006



Pin tap
Product family no. H12101

Pin Tap

Engage a tool joint connection for fishing when other solutions fail

The Baker Hughes pin tap is used to engage a tool joint connection that has been split or flared, or when conventional releasing-type tools have failed. It is also used to engage a tool joint for a backoff. The threaded section of the pin tap is longer than the API pin dimensions for the given thread, which gives flexibility for engagement in a damaged connection.

The pin tap is run into the hole and the top of the fish is lightly tagged. The pin tap is rotated slowly, with free torque in the workstring. While rotating, the pin tap is slowly lowered into the fish until torque begins to build up rapidly. The setdown weight is increased as the torque increases. When the pin is firmly seated in the fish, a backoff is made or the fish is retrieved with straight pull (dependent upon the fishing scenario). Taps are nonreleasable and should be used only when releasing engagement-type tools are not an option.

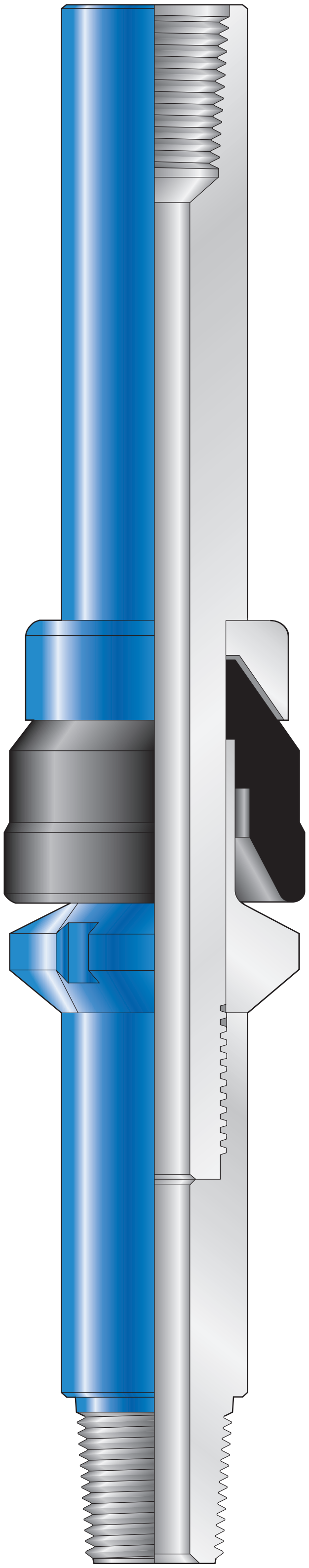
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how our pin tap can engage a tool joint connection for fishing when other solutions fail.

Applications

- In a fishing operation, engage a tool joint connection:
  - That has been split or flared
  - When conventional releasing-type tools have failed
  - For a backoff

Features and Benefits

- Available in most connections
  - Adds flexibility
- Full-bore for wireline
  - Assists in back-offs
- Manufactured from high-quality AISI 4140 material
  - Enhances durability
- Available with right-handed or left-handed tapping threads
  - Eases use with left- and right-hand tubulars
- Carburized wickers
  - Increase durability when tapping into hardened fish



Spear packoff
Product family no. H12115

Spear Packoff

Improve lifting power in fishing operations with hydraulic pressure

The Baker Hughes spear packoff is run just below a casing spear to pack off and allow hydraulic pressure to be applied to the fish. Applying this pressure dramatically improves the lifting power of the fishing string and helps break down sediment or formation by forcing circulation through and around the fish. A continuous seal is enhanced when this pressure is applied. This tool can mean the difference between retrieving a fish the first time, in a single trip, or needing to make another attempt.

The spear packoff is made up to the lower pin connection of a casing spear when fishing for casing. It is guided into the casing by a special guide positioned just below the packing element. When the packoff is inside the casing, spear operation continues. The pump is turned on if the casing needs to be pressurized or circulation needs to be established.

Special care should be taken not to damage the packing element when entering the casing stub, particularly when the casing top has been damaged and has burrs or jagged edges that can cut the element.

The spear packoff is available in casing sizes from 4½ in. – 20 in. (114.3 mm – 508.0 mm).

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn how the Baker Hughes spear packoff can improve lifting power in fishing operations with hydraulic pressure.

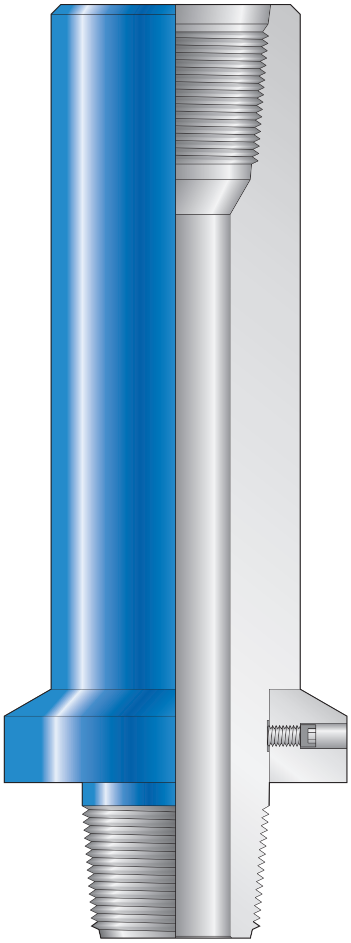
Applications

- Fishing operations

Features and Benefits

- Special guide
  - Allows tool to enter casing without damage to packing element
- Hydraulic pressure
  - Improves lifting power

Internal and External Engagement Tools



Spear stop sub
Product family no. H12036

Spear Stop Sub

Prevent spears from dropping downhole while resetting oil jars

The Baker Hughes spear stop sub can be run on top of any type internal catch spear. Its main purposes are to aid in the release of Bowen Itco-type spears and to prevent the spear from continuing down the hole when you reset the oil jars. It can also be used to positively locate and position your spear into the fish.

The spear stop sub is made up on the bottom of bumper jars, and the correct size of stop ring is installed. The spear stop sub is then made up on top of the spear and run in hole until the stop ring lands on top of the fish. Fishing operations can then proceed.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes spear stop sub prevents spears from dropping downhole while resetting oil jars.

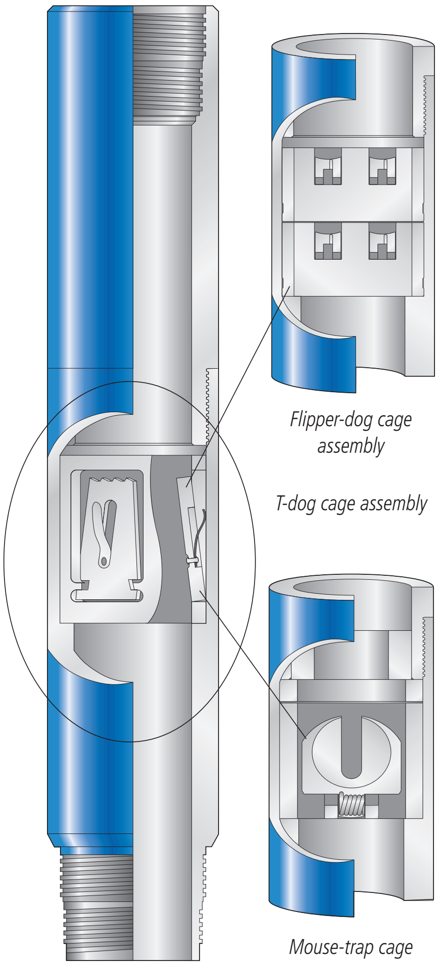
Applications

- Release Bowen Itco-type spears
- Prevent the spear from continuing down the hole when oil jars are reset
- Positively locate and position the spear into the fish

Features and Benefits

- Simple design
  - Simplifies operation and maintenance
- Available in different connections
  - Adds flexibility
- Large selection of stop rings for each sub
  - Can be run on any type of internal catch spear

Internal and External Engagement Tools



Flipper-dog cage assembly

T-dog cage assembly

Mouse-trap cage assembly

TMF overshot
Product family No. H11407

TMF Overshot

Perform up to three different washover or fishing operations with one tool

The Baker Hughes T-dog, mouse-trap, and flipper-dog (TMF) overshot can be dressed three different ways for different washover and fishing applications. It is threaded on both ends so it can be run anywhere in a washover string. Because there are no windows in the body of the tool, it can be used in full washover applications.

The T-dog slips are used to catch square-shouldered collared pipe. The releasable T-dog overshot is used to wash over and recover mud-stuck or sanded-up collared pipe in one trip, when the entire fish can be washed over. This type is releasable.

The mouse-trap assembly is used to catch sucker rod or integral joint tubing. The mouse-trap overshot is effective at fishing cable, coiled tubing, and sucker rods. Depending on the application, the flapper can be dressed with cutting or gripping capabilities, in which case the overshot is not releasable.

The flipper-dog assembly is used to catch integral joint tubing or a fish with different outer diameters. The flipper-dog overshot can be used to wash over mud-stuck, sanded-up collared, or integral joint pipe, in which case the overshot is not releasable.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes TMF overshot helps you provide a variety of fishing solutions.

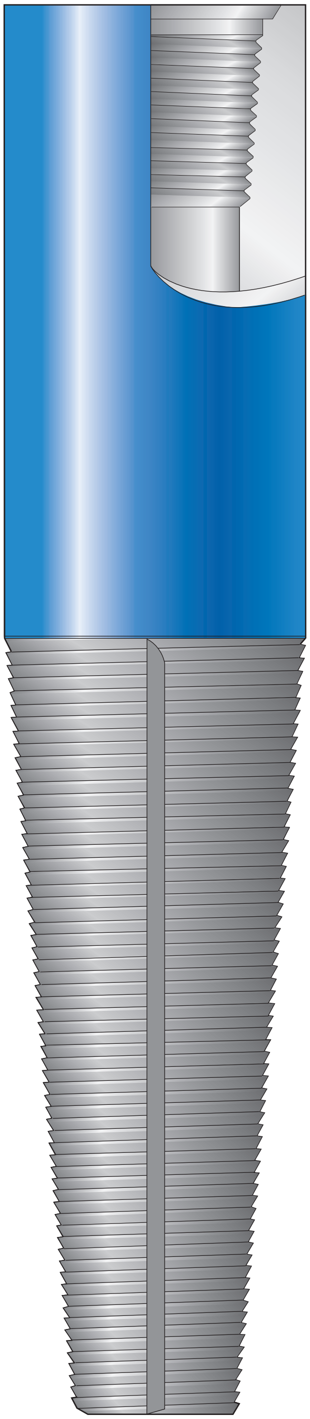
Applications

- Washover operations
- Fish cable, coiled tubing, and sucker rods

Features and Benefits

- Can be dressed three different ways
  - Increases flexibility
- Solid body with no windows
  - Allows overshot to be used in washover string
  - Allows one-trip recovery
- Unique cage design
  - Allows unrestricted passage of coupling through the tool
  - Lets operator wash over several joints of pipe
- Dogs and slips
  - Are energized by springs placing them in the catch position as they pass over and under coupling
- Box X pin washpipe connections
  - Allows overshot to be positioned anywhere in the washover string
- T-dog cage dressing
  - Lets tool be released at any time

Internal and External Engagement Tools



Taper tap
Product family no. H12100

Taper Tap

Engage inside of a fish and pull it when conventional releasing spears cannot

The Baker Hughes taper tap engages the inside of a fish when conventional releasing spears are not feasible. Like the Baker Hughes box tap, the taper tap cuts threads where no threads are present to ensure engagement. Taper taps can be used to fish tubulars, bridge plugs, packers, and other types of downhole equipment.

Taper taps are nonreleasable and should be run with bumper jars and safety joints. They should be used only when releasable engagement-type tools are not an option.

The taper tap is run into the hole and lightly tags the top of the fish. The taper tap is then picked up and rotated slowly, with free torque in the workstring. While rotating, the taper tap is slowly lowered into the fish until the torque begins to build up rapidly. The setdown weight is increased as the torque increases. When the taper tap is firmly seated in the fish, the fish is retrieved with straight pull (dependent on the fishing scenario).

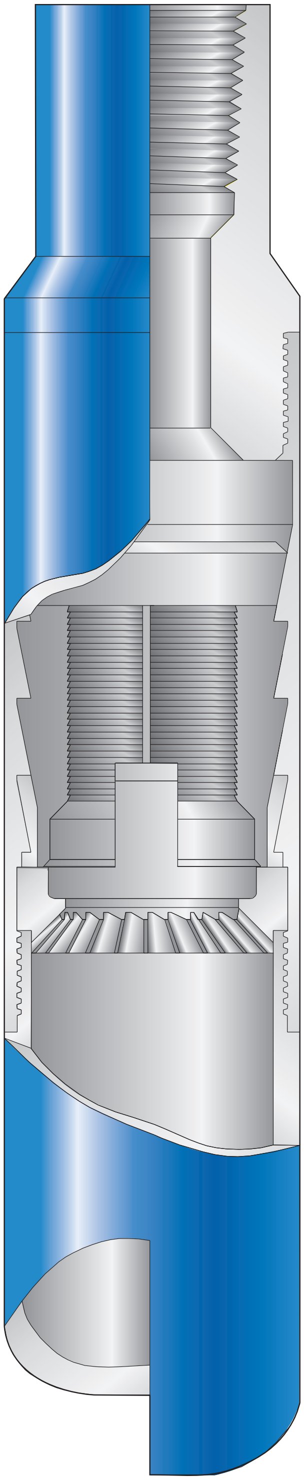
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes taper tap can engage inside of a fish and pull it when conventional releasing spears cannot.

Applications

- Engage the inside of a fish and pull it when a conventional releasing spear is unfeasible
- Fish tubulars, bridge plugs, packers, and other types of downhole equipment

Features and Benefits

- Wide catch range
  - Can retrieve many types of downhole equipment
- Carburized wickers
  - Assist in engaging hardened fish
- Available in right- or left-handed wickers
  - Assists in backing off connections downhole



The series 150 Bowen Releasing and circulating overshot
Product family. No H11507

Series 150 Bowen Releasing and Circulating Overshot

Engage and pull any size fish with extra powerful tool

The Baker Hughes series 150 Bowen releasing and circulating overshot is a powerful tool that externally engages, packs off, and pulls a fish. Its basic simplicity and rugged construction have made it the standard of all external catch fishing tools.

The series 150 Bowen releasing and circulating overshot is composed of three outside parts, namely top sub, bowl, and guide. It can be dressed with either of two sets of internal parts, depending on whether the fish to be caught is near maximum size for the particular overshot. If it is, a spiral grapple, spiral grapple control, and Baker Hughes Type A™ packer are used. If the fish diameter is considerably below maximum size, a basket grapple and a basket grapple mill control packer are used.

Overshot types can be identified by one of the following strengths for which they are engineered:

- Full Strength (FS): withstands all pulling, jarring, and torsional strain
- Extra Full Strength (XFS): engineered for extreme abuse
- Semi-Full Strength (SFS): withstands all pulling strain
- Slim Hole (SH): withstands heavy pulling strain only
- Extra Slim Hole (ESS): engineered for pick-up job only

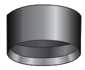
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes series 150 Bowen releasing and circulating overshot tool can help you effectively retrieve fish.

Applications

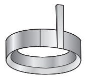
- Externally engage, pack off, and pull a fish

Features and Benefits

- Spiral grapple and control, plus Type A packer accessories
  - Reliably engage and and pull fish of maximum size
- Basket grapple with mill control packer accessories
  - Effectively engage fish well below maximum size



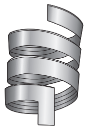
Type A packer



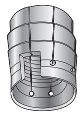
Spiral grapple control

Patented double lip packer

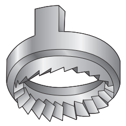
Outer seal



Spiral grapple

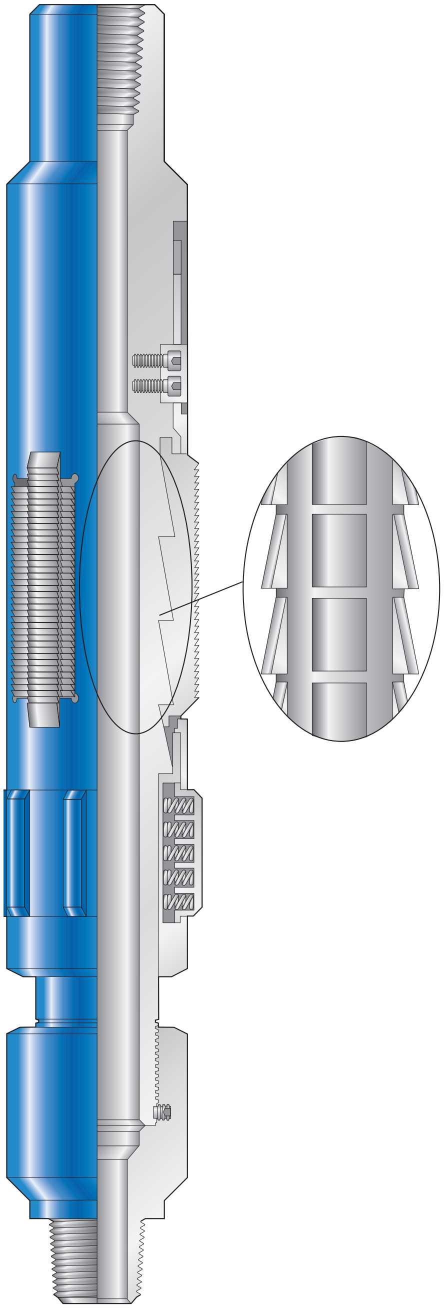


Basket grapple



Basket grapple mill
control packer

Internal and External Engagement Tools



Type B casing and tubing spear
Product family no. H12609

Type B Casing and Tubing Spear

Retrieve casing with easy-release spear

The Baker Hughes Type B casing and tubing spear is used to retrieve casing sizes from 4½ in. to 13⅜ in. (114.3 mm to 339.7 mm). The design of the spear makes it the easiest spear on the market to release. It can be set for left-hand or right-hand release, and is easily field-dressed to change the release setting.

To engage the spear, it is lowered onto the fish until the slips are past the top of the casing. One-quarter rotation places it in the catch position. Because of the slotted mandrel design, the spear can be released with only enough downward travel to break the freeze between the slip segments and the mandrel. After the freeze is broken, the spear is rotated one-quarter round in the release direction to release it.

The spear design protects the slips when it runs down inside the fish, and it can be run to any depth. This feature makes the Type B spear perfect for setting underwater casing patches.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes Type B casing and tubing spear can help you effectively retrieve fish with easy release of the spear.

Applications

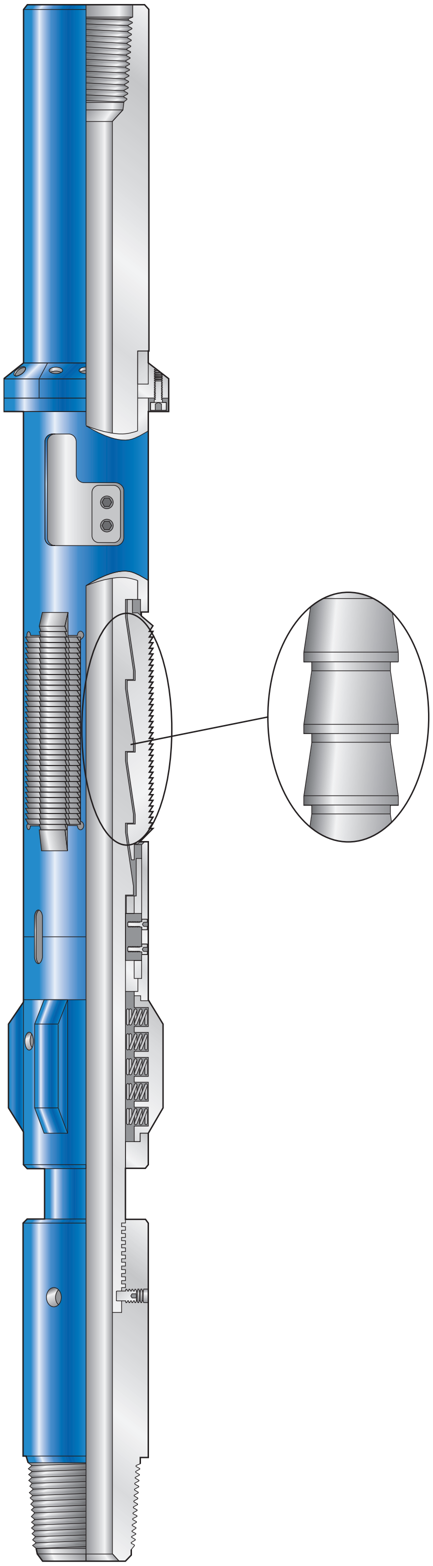
- Retrieve casing
- Set underwater casing patches

Features and Benefits

- Dressings for alternate casing sizes
  - Adds flexibility
- Carburized teeth and large surface area on slips
  - Provide solid positive engagement in fish
- Simple construction
  - Eases operation and maintenance
- Left-hand or right-hand release
  - Allows spear to work in multiple situations
- Optional slips
  - Provide vertical teeth or carbide buttons for backing off
- Easily released
  - Improves reliability and reduces risk

Type D Casing and Tubing Spear

Recover casing and small, lightweight fish economically



Type D casing and tubing spear
Product family no. H12009

The Baker Hughes Type D casing and tubing spear is used to retrieve casing sizes from 4½ in. to 30 in. (114.3 mm to 762 mm). It is ideal for backing off casing or rotating out mudline hangers and packer bore receptacles. The spear can be set for left-hand or right-hand release and is easily field-dressed to change the release setting. The J-slot, which holds the spear in the catch or release position, makes this spear the most reliable solution for recovering small, lightweight fish.

To engage the spear, it is lowered into the fish until the stop ring is taking weight. One-quarter rotation places the spear in the catch position. The spear is released by bumping down and then applying one-quarter rotation in the opposite direction. Because the mandrel must travel down the body length of the J-slot to release, the stop ring should not be removed from the body.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can economically retrieve casing and small, lightweight fish using Baker Hughes Type D casing and tubing spear.

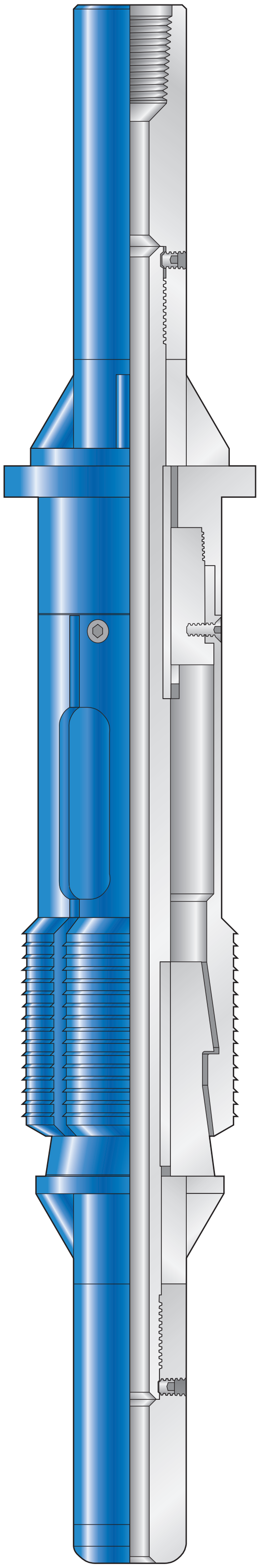
Applications

- Retrieve 4½-in. to 30-in. casing
- Back off casing
- Rotate out mudline hangers and packer bore receptacles
- Recover small, lightweight fish

Features and Benefits

- Slips with carburized teeth and large surface area
  - Provide solid positive engagement in fish
- Simple construction
  - Eases operation and maintenance
- J-slot
  - Holds spear in the catch or release position
- Left-hand or right-hand release
  - Allows spear to work in multiple situations
- Optional slips with vertical teeth or carbide buttons for backing off
  - Provide torsional load

Internal and External Engagement Tools


Type E casing spear
Product family no. H12109

Type E Casing Spear

Retrieve casing in extreme downhole environments

The Baker Hughes Type E casing spear is used to retrieve casing sizes from 7 in. to 30 in. (177.8 mm to 762 mm). It has a heavy-duty, high-strength design for use in the most severe downhole environments. It is normally run in hole in the catch position, and can be run with drill collars and jars when a stuck fish is anticipated.

The Type E spear can be operated in two modes: with or without a stop ring. If the top of the casing is uniform and the outside diameter of the tool is unrestricted, the stop ring is used. In cases of split casing or to set the spear deep within the casing, no stop ring is used. The spear can be released at any time by sharply dropping the string to break contact between the slips and the mandrel and rotating to the right. It can be reset to the catch position by rotating to the left. The spear can be set and released repeatedly without coming out of the hole.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes Type E casing spear can retrieve fish in severe environments.

Applications

- Retrieve 7-in. to 30-in. casing in harsh conditions

Features and Benefits

- Dressings for alternate casing sizes
  - Increases flexibility
- Heavy-duty, high-strength manufacture
  - Withstands the most severe downhole environments
- Simple construction
  - Permits easy operation and maintenance
- Full-bore inner diameter through-tool
  - Accommodates both smaller and larger sizes
- Can be set and released repeatedly without coming out of hole
  - Saves time

Mills and Shoes

Cone Buster Mill

Hollow Mill Container and Insert

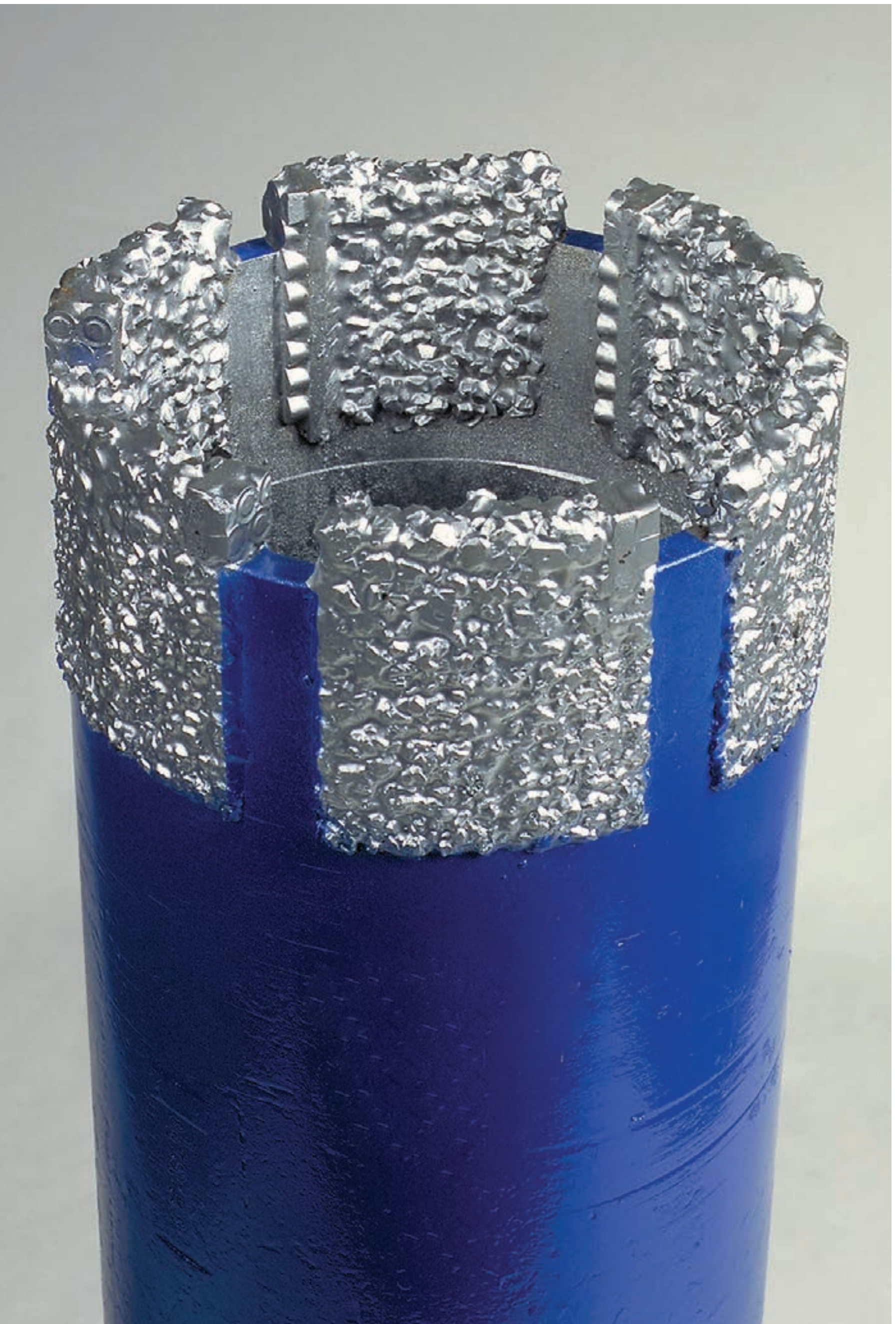
METAL MUNCHER Junk Mill

Piranha Mill

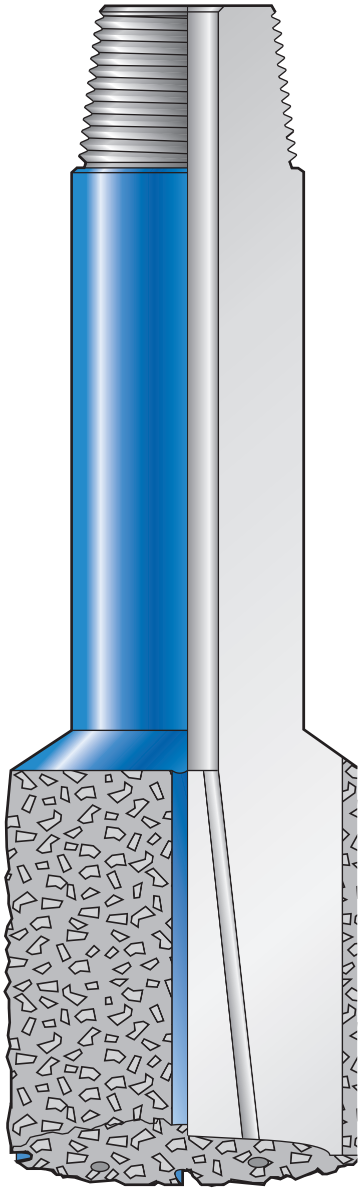
Rotary Shoes

String and Watermelon Mills

Taper Mill



Mills and Shoes



Cone buster mill
Product family no. H15106

Cone Buster Mill

Keep fish centered under mill for greater effectiveness

The Baker Hughes cone buster mill is dressed with SUPERLOY™ carbide on the outside diameter (OD) and has a slightly concave bottom. It is used for milling bit cones or other objects where it is advantageous to keep the fish centered under the mill for greater effectiveness.

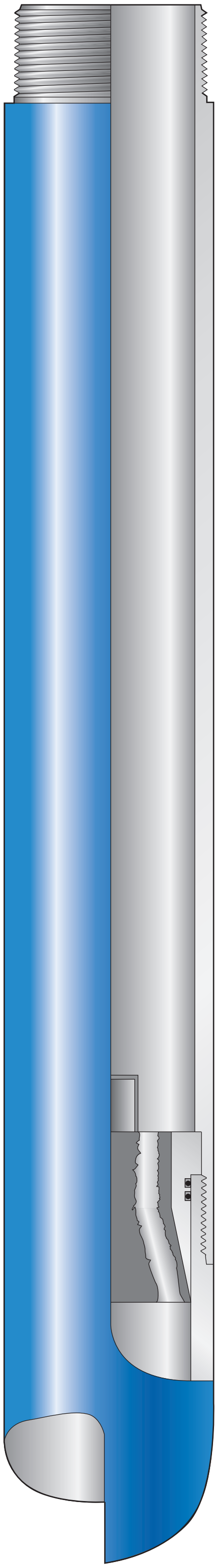
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes cone buster mill can help you effectively mill out fish.

Application

- Milling bit cones in open hole wells
- Milling loose junk
- Dressing off tubulars

Features and Benefits

- Can be spudded on
  - Durability Improves operations and saves time by providing the option to operate aggressively if needed.
- OD dressed with SUPERLOY carbide
  - Improves performance
- Concave bottom
  - Keeps fish centered on the mill to mill cones and similar objects more effectively



Hollow mill container and insert
Product family no. H15120

Hollow Mill Container and Insert

Mill and remove oversized fish tops in one trip

The Baker Hughes hollow mill assembly, which consists of an extension and insert, is used as an overshot accessory to mill away flared or oversized tops of pipe that have been jet-cut or broken off during drilling or workover operations. The hollow mill assembly makes it possible to mill over and recover fish in a single trip.

The hollow mill assembly is installed between the overshot bowl and guide. Because the total torque is applied to the tang of the hollow mill insert, milling requires low weight and torque. After the oversized fish top is milled away, the overshot can be lowered to engage the fish with the basket grapple.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes hollow mill container and insert can help you mill and remover oversized fish tops in one trip.

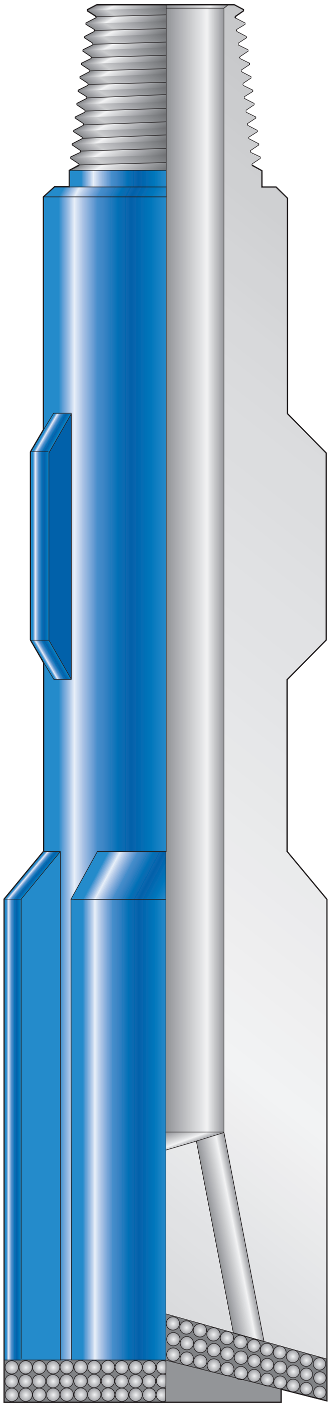
Application

- Mill and retrieve flared or oversized tops of pipe
- Short fishing neck applications

Features and Benefits

- Taper design of insert
  - Permits full removal of flared or oversized fish top
- Mill insert placement
  - Allows fish to be dressed before grapple engages and gives positive indication that the overshot will swallow the fish
- SUPERLOY™ dressing on mill
  - Improves cutting performance
- Insert can be used in place of basket grapple control
  - Allows for short fishing neck applications

Mills and Shoes



METAL MUNCHER™ junk mill
Product family no. H15102

METAL MUNCHER Junk Mill

Mill stationary obstructions with superior strength

The Baker Hughes METAL MUNCHER™ junk mill is used for milling stationary obstructions. It uses the patented METAL MUNCHER technology as the lead cutting structure, and is backed up by SUPERLOY™ tungsten carbide. With the SUPERLOY backing, if the METAL MUNCHER inserts become damaged, the mill performs like a standard junk mill until a new row of inserts is exposed.

The mills have been used to mill cemented tubing, in some cases at rates exceeding 30 ft (9 m) per hour. With this technology, many times cemented drill collars and drillpipe can be milled faster than they can be washed over and recovered.

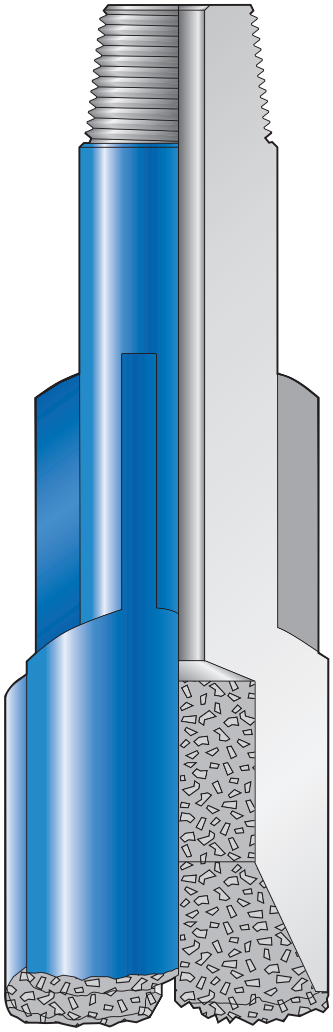
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes METAL MUNCHER junk mill can help you mill stationary obstructions with superior strength.

Application

- Mill stationary obstructions
- Mill cemented tubing, drill collars, and drillpipe

Features and Benefits

- Increased penetration rates
  - Reduces rig time
- Smaller, more uniform cuttings
  - Enhances debris removal
- SUPERLOY and METAL MUNCHER AMT cutting structures
  - Prolong cutter life



Piranha mill
Product family no. H15141

Piranha Mill

Mill with long-lasting cutting surfaces and no risk of coring

The Baker Hughes piranha mill is dressed with SUPERLOY™ carbide and has an offset center to prevent coring. It is used for milling cemented pipe and in situations where there are large amounts of junk in the hole, which requires a mill with a longer life. It is ideal for milling tubing, and can be dressed for openhole or cased hole applications.

The piranha mill is specially designed with a deep V for maximum circulation of fluid and to hold a large amount of tungsten carbide dressing.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes piranha mill gives you long-lasting cutting surfaces and no risk of coring.

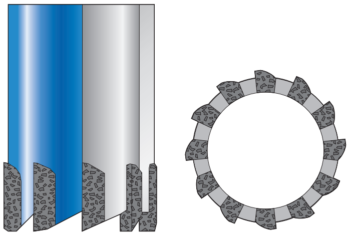
Application

- Mill cemented pipe
- Mill tubing
- Openhole or cased hole applications

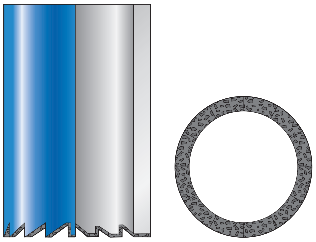
Features and Benefits

- Offset center
  - Prevents coring
- Deep V design
  - Allows maximum fluid circulation
  - Holds maximum amount of tungsten carbide dressing
- SUPERLOY mill dressing
  - Prolongs cutter life

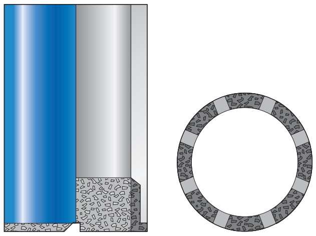
Mills and Shoes



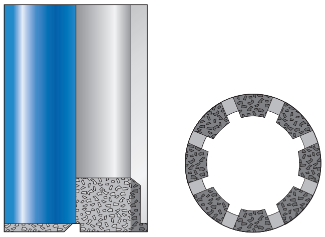
Type A rotary shoe (tooth type, OH)



Type B rotary shoe (tooth type, CH)



Type C rotary shoe (flat bottom, CH)



Type D rotary shoe (flat bottom, CH)

Rotary Shoes

Select from 11 shoe types for best washover or milling performance

The Baker Hughes rotary shoes are used on the bottom of washpipe in washover or milling operations. They are made from heat-treated alloy steel and dressed with SUPERLOY™, METAL MUNCHER™, or Opti-Cut™ cutters. The specific application will determine the type of shoe best suited for the job.

The Type A™ rotary shoe (tooth type, openhole [OH]) is used for washing over and cutting formation. The mill tooth design with side wings allows maximum circulation. This shoe cuts on the outside and bottom only.

The Type B™ rotary shoe (tooth type, closed hole [CH]) is used for washing over. The mill tooth design of this shoe permits maximum circulation consistent with limited clearances. The Type B shoe cuts on the bottom only.

The Type C™ rotary shoe is used to cut metal on the fish where clearances are small. This shoe cuts on the inside and bottom only.

Similar to the Type C shoe, the Type D™ rotary shoe has an internal upset for use where clearance permits, allowing the cutting structure to be placed without restricting the ID of the shoe stock itself. This shoe cuts on the inside and bottom only.

Application

- Wash over debris-ridden fish
- Milling formation, metal, fish, cement, packers, and jagged edges of junk
- Reverse-circulation applications

Features and Benefits

- SUPERLOY, METAL MUNCHER, or Opti-Cut dressing
  - Can be ordered to meet specific needs of each job
- Heat-treated alloy steel used in manufacture
  - Improves durability and performance
- Mill-tooth design with side wings (Type A shoe)
  - Allows maximum circulation
- Mill-tooth design (Type B shoe)
  - Allows maximum circulation consistent with limited clearances

Mills and Shoes

The Type E™ rotary shoe is used for washing over a fish in the open hole. It cuts on the outside and the bottom only.

The Type F™ rotary shoe cuts on the outside, inside, and bottom. It is used for washing over and cutting the formation and the fish at the same time.

The Type G™ rotary shoe is used to wash over fish and cut metal, formation, or cement in the open hole with limited clearances. It cuts on the outside diameter (OD) and the bottom, but does not cut on the inside diameter (ID).

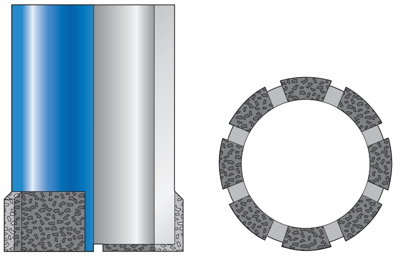
The Type H™ rotary shoe is used to mill away jagged edges from small junk or bit cones so junk will pass into a junk basket to be retrieved. It is also used to cut formation for small cores. This shoe is effective in reverse-circulation applications.

The Type K™ rotary shoe with a scallop or wavy shaped bottom is used to wash over and cut on the bottom face only. It does not cut on the ID or OD.

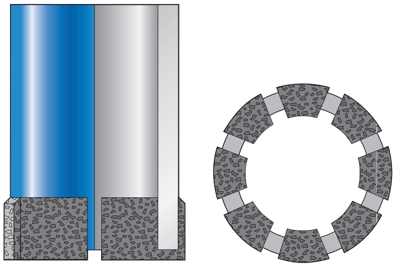
The Type J™ rotary shoe has a scallop or wavy shaped bottom, and cuts on the ID, the OD, and the bottom face.

The METAL MUNCHER rotary shoe can be used to mill over packers. It cuts on the bottom face and the ID.

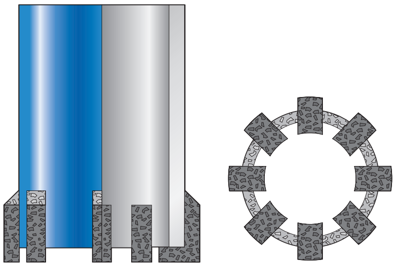
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out which of the 11 Baker Hughes rotary shoe types is best for your washover or milling job.



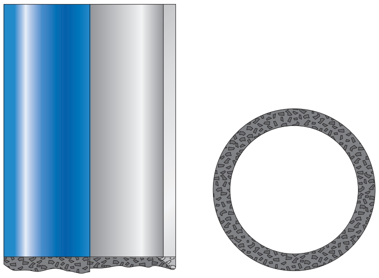
Type E rotary shoe (flat bottom, OH)



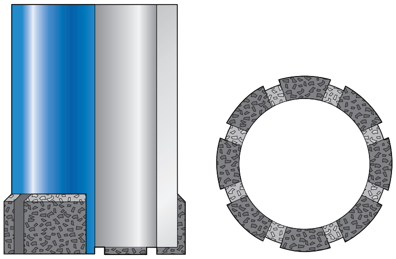
Type F rotary shoe (OH)



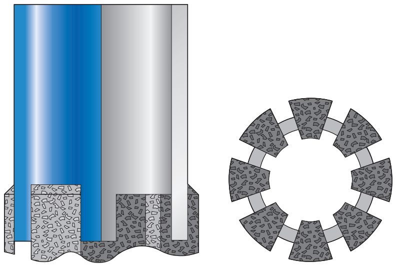
Type H rotary shoe (OH)



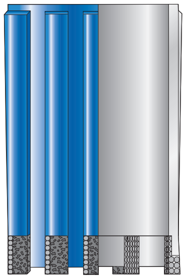
Type J rotary shoe (OH)



Type G rotary shoe (OH)

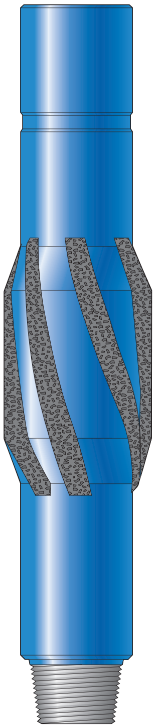


Type K rotary shoe (CH)

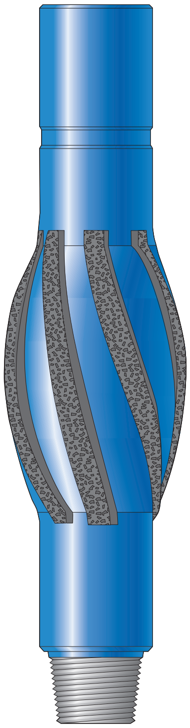


METAL MUNCHER™ (crown type) rotary shoe (CH)

Mills and Shoes



String mill
Product family no. H15109



Watermelon mill
Product family no. H15109

String and Watermelon Mills

Mill, dress, and stabilize the workstring and BHA in milling and drilling operations

Baker Hughes string and watermelon mills can mill, dress, and stabilize the workstring and bottomhole assembly (BHA) in milling and drilling operations. Another feature is the ability to elongate casing windows during a whipstock operation. They can also be used to remove tight spots, restrictions, or dog legs in casing.

These types of mills are often run above section mills so any bird nesting of cuttings can be broken up and circulated to ensure that the section mill can be pulled out of the well. Most of these mills have a standard drillpipe or drill collar connection to eliminate crossovers.

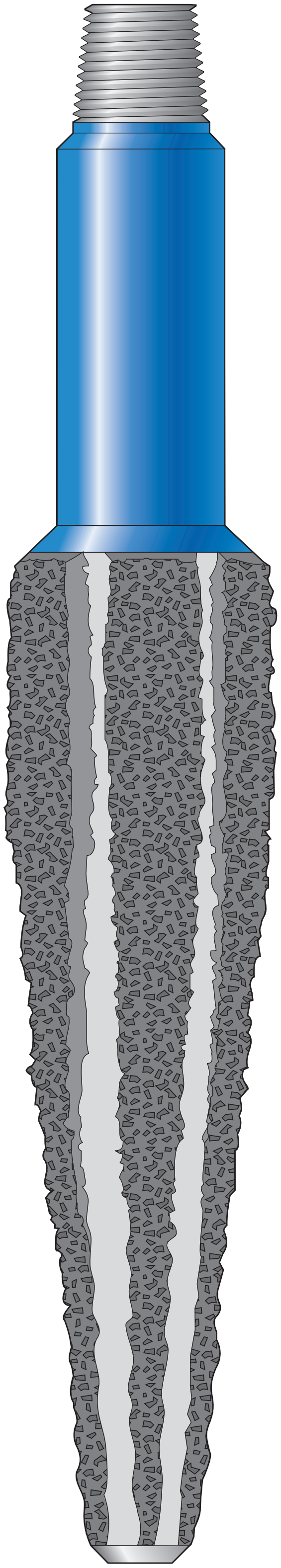
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishing services to find out how Baker Hughes string and watermelon mills can mill, dress, and stabilize the workstring and BHA in milling and drilling operations.

Application

- Mill away any restrictions
- Stabilize milling, cutting, and drilling assemblies
- Precompletion hole conditioning

Features and Benefits

- Can be inserted into workstring at any point
  - Is customizable to various scenarios
- SUPERLOY dressing
  - Improves performance and longevity of mills
- Can be dressed rough or smooth OD
  - Can be customized to appropriate hole conditions



Taper mill
Product family no. H15110

Taper Mill

Mill restrictions and obstructions in casing, tubing, or open hole

The Baker Hughes taper mill enters restricted areas in casing, tubing, or open hole and removes wellbore restrictions or obstructions by milling. Taper mill designs vary, based on the intended use.

Taper mills designed for uses inside casing are dressed with SUPERLOY™ carbide beginning at the reduced outside diameter (OD) at the bottom of the mill to the full drift of the casing. When full-drift OD is reached, the taper mill will have a length of smooth, turned-down SUPERLOY dressing for stabilization, minimizing any unnecessary casing damage. For openhole applications, the rough SUPERLOY cutting structure extends over the entire dressed area of the mill.

When run with a section or pilot mill, the taper mill acts as a stabilizer, reducing vibration and increasing section mill life. The taper mill also acts as a guide when bottomhole assemblies (BHAs) enter the casing.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about how the Baker Hughes taper mill can mill restrictions and obstructions in casing, tubing, or open hole.

Application

- Mill out wellbore restrictions
- Dress underguaged hole sections
- Positive entry and lower stabilization for various BHAs

Features and Benefits

- Mills restrictions from the casing inner diameter
  - Promotes more efficient operation
- Minimally aggressive design
  - Can be used to open a damaged window or parted casing
- METAL MUNCHER™ Advanced Milling Technology (AMT™) and SUPERLOY dressing
  - Improves performance and longevity

Notes

Cutting Structure Types and Applications

Diamond Cutting Structures

METAL MUNCHER Advanced Milling Technology

Opti-Cut Cutters

SUPERLOY Milling Material

Cutting Structure Types and Applications

Diamond rotary shoe

Diamond speed mill

PathMAKER™ formation mill

Diamond Cutting Structures

Cut and mill hard formations and materials more effectively

The application of Baker Hughes synthetic polycrystalline diamond compact (PDC) and surface-set diamonds for milling tools bolsters cutting and milling operations that involve hard material such as carbide, hardbanding, or hard formations. PDC inserts are used in operations where hard formations or long sections are underreamed. Surface-set diamonds are used to dress mills and shoes in applications involving extra hard material.

Diamond speed mills are commonly used to cut hard material and formation together. Diamond rotary shoes are commonly used to cut over stuck bottomhole assemblies (BHAs) with hardened or insert-type stabilizers.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes PDC and surface-set diamonds can help you cut and mill hard formations.

Applications

- Cut and mill hard formations and materials
- Underream hard formations or long sections
- Cut over stuck BHAs

Features and Benefits

- Extra hard cutting edges
  - Can mill extra hard formations and materials
- Extremely hard material
  - Extends mill and cutter life

Cutting Structure Types and Applications

METAL MUNCHER™ AMT cutters

METAL MUNCHER Advanced Milling Technology

Reduce milling trips and time with superior material and design

The cutting structures created with Baker Hughes METAL MUNCHER™ advanced milling technology (AMT) offer enhanced wear rate, impact resistance, and cutting edge, resulting in shortened milling time. They address the more exotic and abrasive materials commonly encountered in today's milling and fishing operations, maximizing performance in a wider range of applications and in less time.

Because the blades using AMT material offer greater durability and maximized cutter life, fewer trips are needed to complete the operations and redundant equipment can be eliminated. The more durable metallurgy in Baker Hughes' line of METAL MUNCHER AMT cutting structures also results in longer trips and less nonproductive time, further decreasing operational expenses.

The AMT portfolio is ideal for cutting casing for plug and abandonments, pipe that's stuck with scale, reentry portions, dressing off hard-banding, and even titanium logging tools. The wide range of metallurgical treatments and cutting shapes available enhance our ability to provide solutions for all such applications. Debris size and shape is controlled and minimized through the improved penetration rates of this stronger material and through the application of a custom-fit solution based on the unique designs available in AMT material.

Baker Hughes leads the industry with the widest array of value-adding solutions that will meet any cutting needs. Our significant investments in research and development improve your ability to drill efficiently and successfully. To find out more about how the new Metal Muncher AMT cutting solution improves milling time, maximizes penetration rate and cutter life, and minimizes trips required, contact your Baker Hughes representative today or visit www.bakerhughes.com/metalmuncheramt.

Applications

- All environments
- Deep water
- Unconventional oil and gas
- High-volume milling applications
- Pilot, section, and packer milling through exotic materials
- Plug and abandonment

Features and Benefits

- Wide range of cutting shapes and metallurgical choices, such as pyramid-shaped or rectangular
  - Enables optimization of each unique milling application (exotic material, high-volume cutting, high durability, high impact)
- In-depth analysis of each well's needs and ongoing review
  - Provides custom-fit solution, including a variety of cutting structures if needed
- Uses new design and carbide metallurgies
  - Increases milling penetration rate
- Reduces milling time associated with exotic materials
  - Saves operating cost
- Cutter durability
  - Eliminates redundant equipment
  - Enables more time on bottom, reducing trips required
  - Decreases operational expenses
- Tightly controlled welding processes and quality controls
  - Offers consistent dependability

Cutting Structure Types and Applications

Opti-Cut™ cutters

Opti-Cut Cutters

Increase rate of penetration with optimum-shaped geometry and enhanced cutting edges

Baker Hughes Opti-Cut™ cutters are used for thru-tubing fishing, packer milling, washover shoes, casing/tubular cutting, and milling anywhere extremely sharp cutting edges are desirable. They are available in rods similar to the SUPERLOY™ crushed carbide rods, and are manufactured using the same unique, proprietary heat guidelines.

Opti-Cut™ cutters provide a technological improvement over standard products, and are suitable for applications such as high impact or interrupted-cut milling. They perform like the SUPERLOY carbide cutters, but each piece optimizes identical geometry so that no matter how the cutter is placed on the body of the cutting or milling tool, a sharp cutting edge or point faces up: as the cutter is worn down, new cutting edges and points are exposed. The Opti-Cut cutter has 16 cutting points and eight cutting edges for superior cutting ability.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how Baker Hughes Opti-Cut cutters can increase the rate of penetration with consistently sharp edges.

Applications

- Thru-tubing fishing
- Milling packers
- Washover shoes
- Cutting casing and tubulars

Features and Benefits

- Optimum-shaped geometry
  - Ensures that cutting edges and points always face up
- 16 cutting points and eight cutting edges
  - Provides superior cutting ability
- Sharper edges and points
  - Lowers weight
  - Increases rate of penetration
- Rod form
  - Eases application
- Increased surface area
  - Improves bonding to base metal
- Dual concave ends
  - Exposes maximum area of cutting points
- Smaller cuttings
  - Allows for easier circulation out of hole

Cutting Structure Types and Applications

SUPERLOY milling material

SUPERLOY Milling Material

Mill and wash over more successfully with high-strength material

Baker Hughes SUPERLOY™ material is composed of crushed sintered-tungsten particles that are suspended in a special copper-base, brazing-type alloy with high nickel content, and is used to dress cutters and mills to maximize cutting effectiveness. Tungsten carbide is the finest milling material available for downhole steel cutting or milling tools. SUPERLOY material can be used on all types of downhole cutting and milling tools.

Predressed junk mills and rotary shoes are available in all types and sizes, as are tapered and string mills of various outside diameters (ODs). SUPERLOY material works well on milling loose junk such as bit cones, tong dies, and packers, and for washing over stuck or cemented pipe. It can be used to mill off the OD or inside diameter (ID) of casing to provide a clean top for casing patch operations. It is also effective as a dressing on upper and lower watermelon mills in the Baker Hughes WindowMaster™ whipstock window-cutting system.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how Baker Hughes SUPERLOY high-strength material can enhance the success of milling and washover operations.

Applications

- Dress cutters and mills
- Dress OD and ID of casing

Features and Benefits

- Highest-quality tungsten carbide
  - Maximizes cutting effectiveness
- Rod form
  - Eases application
- Ideal for junk milling of all sizes
  - Expands use of tool to multiple applications

Notes

Packer Milling and Retrieving Tools

CK Packer Milling Tool

Hydraulic Packer Retrieving Tool

Mechanical Packer Retrieving Tool

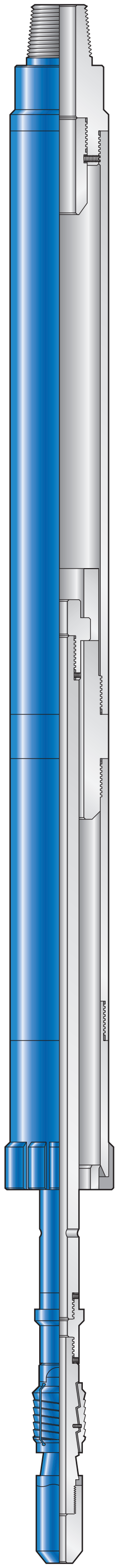
METAL MUNCHER Packer Mill

M J-Joint

Quick Pick Packer Milling System

Shear Pin Packer Retrieving Tool

Packer Milling and Retrieving Tools



CK™ packer milling tool
Product family no. H74708

CK Packer Milling Tool

Mill and retrieve production packers with smooth bores in one trip

The Baker Hughes CK™ packer milling tool is used to mill over and retrieve retainer production packers with sealbore extensions, pup joints, landing nipples, and other items that have a smooth bore. It includes a spear that latches onto and retrieves the body of the packer after the packer's outside portion has been milled up.

When the packer is reached, the spear is set down with a weight of 5,000 lb (2268 kg) to 10,000 lb (4536 kg) until the spear is in the packer bore. Then, approximately 15,000 lb (6804 kg) to 20,000 lb (9072 kg) upstrain is used to engage the spear in the packer bore. When the spear is properly engaged, the drill string is picked up slightly above neutral position. The drill string is slowly lowered with slight right-hand torque. A downward movement of approximately 3 ft (.9 m) releases the mill from the J-slot, and then milling operations can begin.

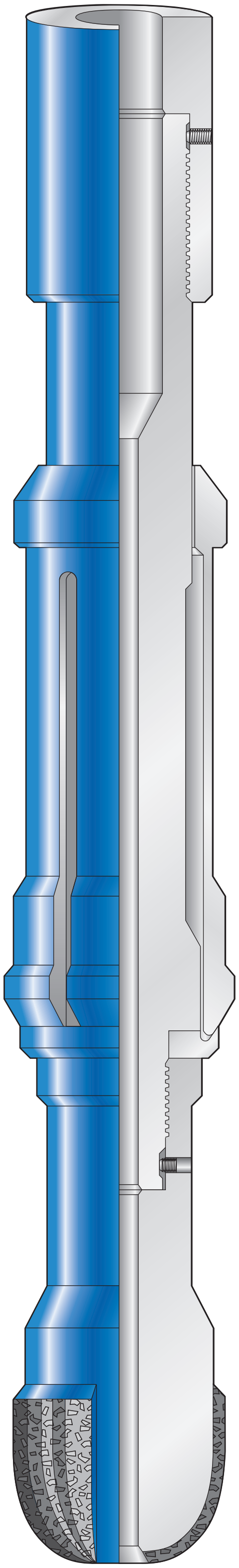
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how Baker Hughes CK packer milling tool can help you mill and retrieve production packers.

Application

- One-trip packer milling and removal

Features and Benefits

- Can be released to replace the shoe if needed
  - Adds flexibility



Hydraulic packer retrieving tool
Product family no. H14066

Hydraulic Packer Retrieving Tool

Retrieve permanent packers from highly deviated wells in one trip

The Baker Hughes hydraulic packer retrieving tool provides a reliable method of milling and retrieving permanent packers in one trip. It provides two methods to release from the packer downhole.

The primary release is activated by increasing the flow rate through the tool, forcing the grapple up the mandrel into the release position. The increased circulation rate is maintained until the spear has been pulled through the packer bore. This method has proven especially beneficial in highly deviated holes where the activation of J-slots or straight over-pull shearing can be difficult.

The secondary method of releasing is accomplished by shearing the emergency shear ring. Normal shear ring values range from 200,000 to 500,000 lb (90 719 to 226 796 kg) of overpull. Hydraulic jars should be run to apply the high shearing force required at the tool.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can retrieve permanent packers from highly deviated wells in one trip using the the Baker Hughes hydraulic packer retrieving tool.

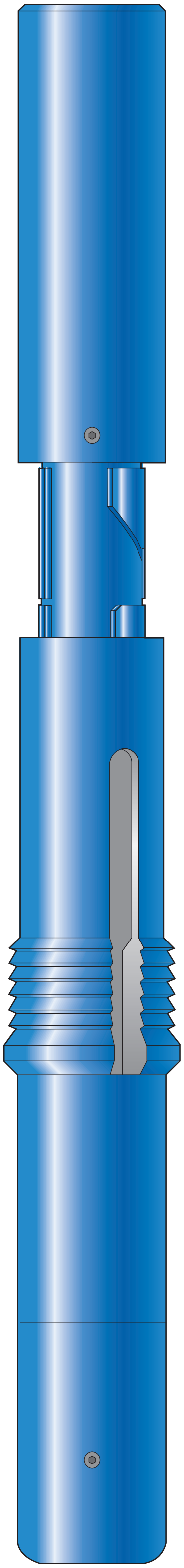
Application

- Milling and retrieving permanent packers
- Highly deviated wells

Features and Benefits

- Simple design, with grapple as only moving part
  - Reduces risk
- Hydraulic release
  - Provides easy release mechanism in highly deviated wells
- Emergency shear-ring release
  - Reduces risk
- Can be used with packer mill or burning shoe
  - Adds versatility
- May be latched and released repeatedly
  - Eases operation

Packer Milling and Retrieving Tools



Mechanical packer retrieving tool
Product family no. H14031

Mechanical Packer Retrieving Tool

Mill and retrieve drillable packers in a single trip

The Baker Hughes mechanical packer retrieving tool removes drillable packers from the wellbore. It is used as the retrieving mechanism of a packer milling-retrieving assembly. It passes through the bore of the packer and engages the lower end of the packer to allow a one-trip milling and recovery operation.

The tool is installed at the lower end of the milling assembly by means of extension joints. This allows the spear to clear the lower end of the packer bore before the packer milling shoe or mill makes contact with the outside of the packer. When the spear enters the packer bore, the retrieving slip is forced up into a position where the outside diameter (OD) is reduced to allow passage through the packer bore. As the slip clears the lower end of the packer, it drops into the catch position. The milling operation can now be performed and the packer retrieved.

The spear will remain in the catch position and withstand severe upward strain and sudden movement of the packer. If necessary, the retrieving spear can be released from the packer bore by right-hand rotation and lowering of the fishing string after the spear slip has been pulled into friction contact with the packer bore.

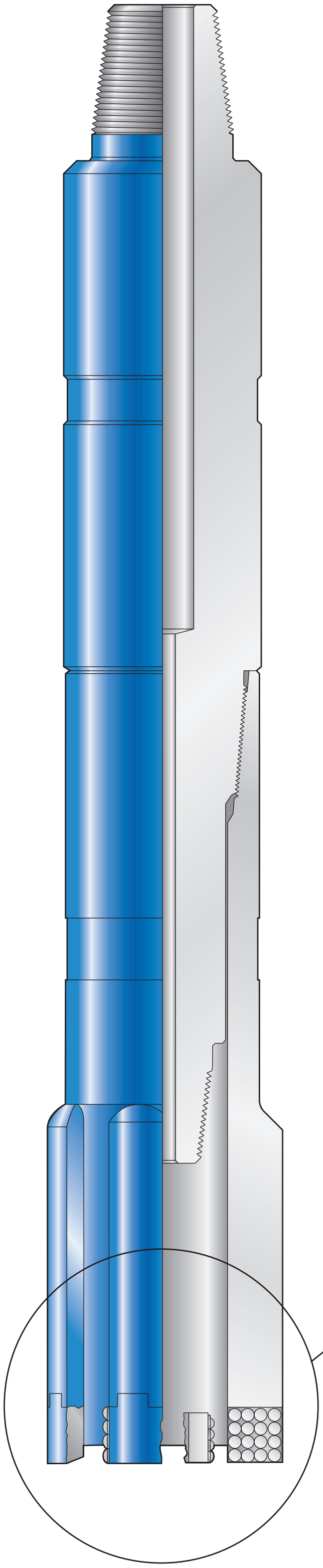
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about milling and retrieving drillable packers in a single trip using the Baker Hughes mechanical packer retrieving tool.

Application

- Mill and recover drillable packers

Features and Benefits

- Can be released and reengaged multiple times
  - Eases operation
- Hydraulics or shearing by overpull not needed to release the spear
  - Allows versatility for various well geometries
- Robust design
  - Allows for impact
  - Can be run with a jarring assembly
- Wide variety of grapple sizes
  - Increases flexibility



METAL MUNCHER™ packer mill
Product family no. H14071

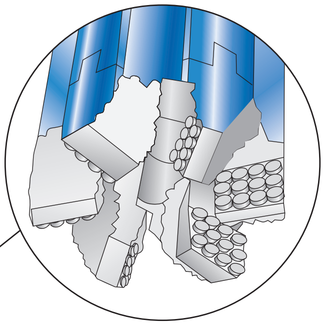
METAL MUNCHER Packer Mill

Mill packers quickly without creating large debris

The Baker Hughes METAL MUNCHER™ packer mill can mill packers in the shortest possible time without creating large debris. It uses patented METAL MUNCHER technology as the lead cutting structure backed up by SUPERLOY™ carbide. With the SUPERLOY backing, if the METAL MUNCHER inserts become damaged, the mill performs like a standard packer mill until a new row of inserts is exposed.

The METAL MUNCHER packer mill can be used with most packer retrieving spears. The aggressive cutting structure of the inserts is also effective in milling high-chrome, harsh-environment packers. It produces smaller cuttings for easier wellbore cleanout.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes METAL MUNCHER packer mill can help you mill packers quickly without leaving large debris.



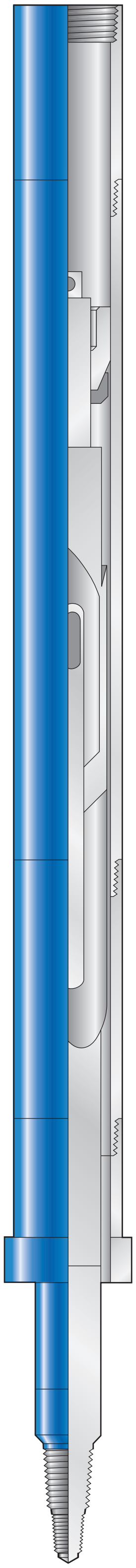
Bottom view

Application

- Mill rapidly with small cuttings
- Mill high-chrome packers
- Harsh environments

Features and Benefits

- METAL MUNCHER technology
  - Increases penetration rate for faster milling operations
- Smaller cuttings
  - Eliminate large pieces of packer to be removed
  - Ease ability to clean out wellbore
- SUPERLOY backing
  - Ensures reliability and durability
- AISI 4140 heat-treated alloy steel construction
  - Provides extra strength and reliability
- Allows spudding
  - Reduces spinning of packer components such as rings or cones



M™ J-Joint
Product family no. H14133

M J-Joint

Burn over and retrieve packers without risking accidental release

The Baker Hughes M™ J-joint is used in conjunction with a washover assembly to burn over and retrieve packers in one trip. It has a simple, two-piece design consisting of the outer body and the double-J mandrel. The three main advantages of this tool are the double-J release, the ability to pull out of hole and replace shoe without releasing the engagement device, and the ability to engage the fish with any type of fishing tool before the burnover operation while remaining engaged throughout the operation.

The double-J design of the mandrel eliminates the need to run any type of safety joint below the releasing joint. This is a great advantage when a taper or box tap must be used. The double-J also makes it possible to use higher weights both up and down without accidentally releasing.

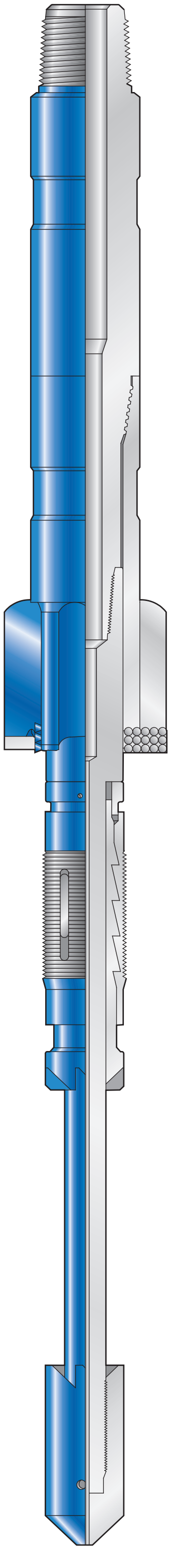
Contact your local Baker Hughes representative or visit www.bakerhughes.com/fishingservices to learn more about how out M J-joint can burn over and retrieve packers without risking accidental release.

Application

- Burn over and retrieve packers

Features and Benefits

- Double-J design
  - Eliminates risk of accidental release with redundant slots
- Any type engaging mechanism can be run
  - Connection on bottom gives versatility to run various engaging devices
  - Eliminates the need for a safety joint
- Easily releases and reengages multiple times
  - Eases operation
- Can be manufactured with any washpipe connection
  - Adds flexibility
- Manufactured from AISI 4140 heat-treated alloy steel
  - Increases durability



Quick Pick™ packer milling system
Product family no. H14028

Quick Pick Packer Milling System

Mill and retrieve packers in extremely quick single trips

The Baker Hughes Quick Pick™ packer milling system takes the shortest possible time in only one trip to mill packers and retrieve them. The system contains a mill that uses patented METAL MUNCHER™ technology as the lead cutting structure, with SUPERLOY™ backing that allows the mill to perform like a standard packer mill if the METAL MUNCHER inserts become damaged. The aggressive cutting structure of the inserts can be effective in milling high-chrome, harsh-environment packers.

The system also contains an innovative packer retriever that is directly connected to the packer mill, and allows engagement of packers with a seal bore or a smooth inside diameter (ID). This allows for constant rotation while remaining in the engaged position to prevent the packer from falling when it breaks loose. It can be engaged and released multiple times.

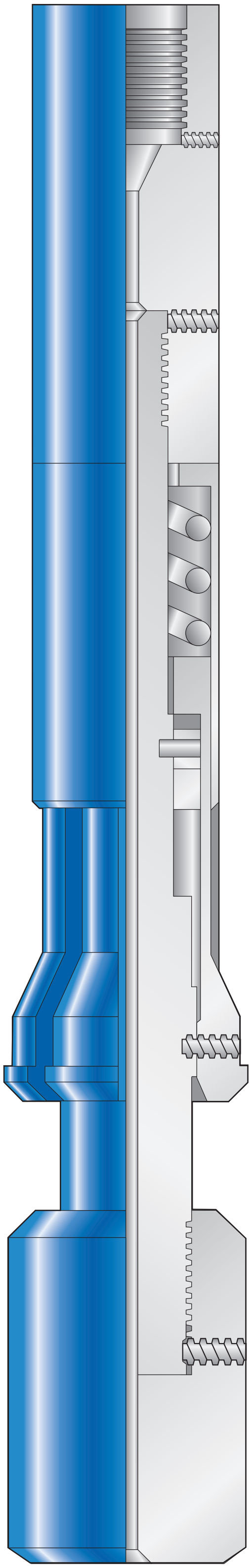
The correct milling head and retrieving tool should be selected for the job, with the outside diameter (OD) equal to the drift ID of the casing size and weight you will be working in. The assembly consists of a mandrel that is torqued up to a drive sub and milling head. The mandrel consists of a slide bearing/grapple carrier with an interchangeable grapple and a bottom nut to engage the grapple carrier if required. In the milling position, the top of the grapple must be no more than 4 in. (101.6 mm) below the bottom of the mill head.

Application

- Milling high-chrome packers
- Milling packers with a seal bore or smooth ID
- Harsh environments

Features and Benefits

- Increased penetration rate
  - Speeds up milling
- METAL MUNCHER cutting structure
  - Increases mill life
- Smaller cuttings
  - Increases ability to clean out wellbore
  - Eliminates large pieces of packer to be removed
- SUPERLOY backing
  - Reduces spinning of packer components such as rings or cones



Shear pin packer retrieving tool
Product family no. H14136

Shear Pin Packer Retrieving Tool

Drill and remove drillable packers in one trip

The Baker Hughes shear pin packer retrieving tool (PRT) is a combination mill and spear that recovers drillable packers in a one-trip milling and recovery operation.

Before the tool is run, it is important to ensure that the proper grapple has been installed, sufficient lengths of PRT extension joints have been added, and the correct number of shear pins have been installed in the spear mandrel and grapple. As the spear enters the packer bore, the grapple shear set screws shear, giving a positive indication of entry into the packer. The grapple remains in the catch position during the milling operation. If it is necessary to release the spear from the packer, the workstring is picked up to the load that has been predetermined to shear the pins in the spear mandrel.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes shear pin packer retrieving tool can help you drill and remove drillable packers in one trip.

Application

- Mill and recover drillable packers
- High-angle holes

Features and Benefits

- Unique shear pin design
  - Eliminates J-ing action in the event this type of manipulation is problematic in deviated well bores
- Spear is releasable from the packer
  - Provides options for contingency if packer cannot be removed, or if well conditions become unfavorable
- Can be run with packer mill
  - Versatile design allows multiple applications

Specialty Tools

Hydraulic Casing Backoff Tool

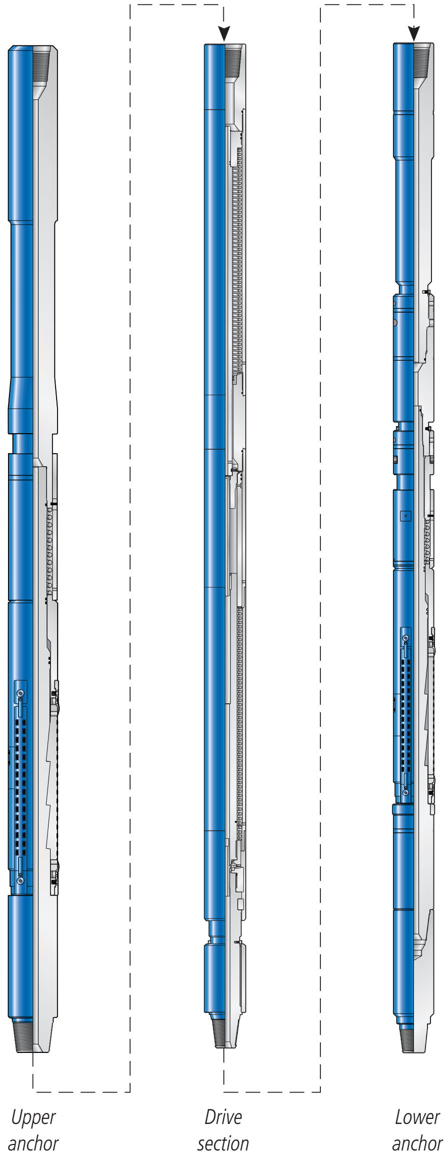
Hydraulic Pulling Tool

Marine Swivel Seal Extractor

RatPACK Retrievable Packer Impulse Tool

Universal Wellhead Retrieving System

Specialty Tools



Hydraulic casing backoff tool
Product family no. H14210

Hydraulic Casing Backoff Tool

Eliminate blind backoffs of casing with known coupling depth and location

The Baker Hughes hydraulic casing backoff tool is used to back off casing at a known or desired coupling depth and location, eliminating blind backoffs of casing. It is often used as an alternative to running a casing patch during a casing repair program.

The typical hydraulic casing backoff tool assembly consists of one stand of drill collars, mechanical collar locator, lower anchor section, backoff section, upper anchor section, pump out sub, several stands of drill collars, and workstring. Normally, the casing is cut and pulled, then the hydraulic casing backoff tool is used to remove the stub.

The tool is assembled and run in the well to the desired depth. The mechanical collar locator pinpoints the collar to be backed off and the backoff tool straddles the collar. The anchor sections are set hydraulically and the tool is then cycled until breakout is accomplished. The pump is turned off and the workstring picked up. This releases the anchors and allows the tool to be tripped out of the well. The backed off casing is then retrieved with an appropriate spear.

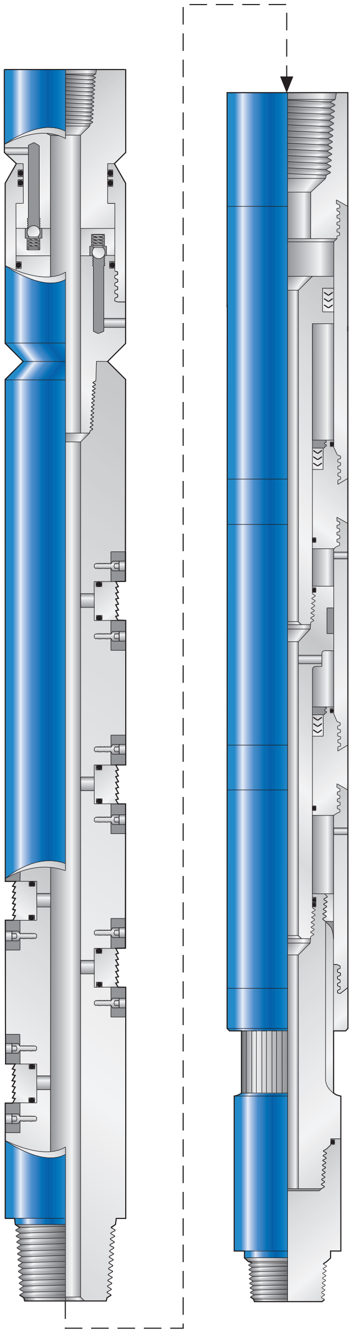
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes hydraulic casing backoff tool can help you back off casing efficiently.

Applications

- Back off casing at a known or desired coupling location
- An alternative to running a casing patch during a casing repair

Features and Benefits

- High torque breakout capacity
  - Can back off premium threaded casing
- Anchor sections with special carbide insert slips
  - Make firm bites into casing ID to withstand torque output of tool
- Leaves threaded connection
  - Re-engages with new casing string
  - Maintains full casing integrity when casing is screwed back together properly
- Original wellbore maintained
  - Eliminates restricted ID after repairing casing
- Minimal well site requirements
  - Requires no left-hand workstrings for backoff
- Over-torqueing of tool joints is eliminated
  - Reduces thread damage and deformed connections
- Can be used with tubing as a workstring
  - Increases flexibility



Hydraulic pulling tool
Product family no. H14027

Illustration not shown to scale

Hydraulic Pulling Tool

Pull objects hydraulically from wellbore with minimum risk to casing

The Baker Hughes hydraulic pulling tool pulls objects from cased wellbore using hydraulic pump pressure. It anchors in the casing, exerts a pulling force on the fish below, and transmits the force to the casing rather than the surface equipment. This design allows the pulling tool to be used with most conventional workover rigs and small workstrings. It can be used to pull liners, retrievable packers, or any other objects that require heavy pulling strains. It also can be used with mechanical fishing tools such as an overshot, spear, or screw-in assembly.

The hydraulic pulling tool is composed of three sections:

- The relief valve, which is run on top of the tool and allows release of the slips if differential pressure exists at the tool and prevents pulling of a wet string
- The anchor section, which is run immediately below the relief valve and anchors the tool to the casing wall, providing a large slip engagement area to safely transmit the heavy pulling strains with minimum risk to the casing
- The pulling section, which is run below the anchor section and above a blanking sub so that hydraulic pressure can be applied

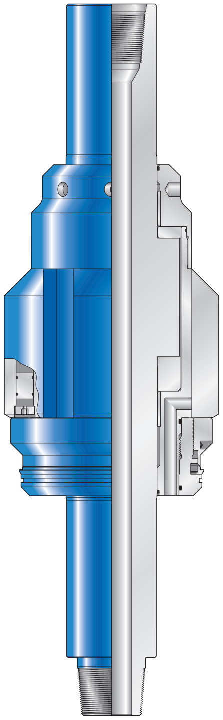
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how our hydraulic pulling tool can pull objects from the wellbore with minimum risk to casing.

Applications

- Pulls objects from cased wellbore
- Pull anything requiring heavy pulling strains
- Use with:
  - Conventional or low-weight capacity workover rigs
  - Small workstrings
  - Any mechanical fishing tool

Features and Benefits

- Operates off rig pumps or reversing unit
  - Eliminates need for additional pumps on location
- Anchors in casing
  - Transmits pulling force to casing



Marine swivel seal extractor
Product family no. H17002

Marine Swivel Seal Extractor

Position a cutter with pinpoint accuracy in volatile offshore environment

The marine swivel seal extractor is used exclusively on floating rigs to suspend a cutting string in a fixed vertical position and position and stabilize it for an accurate cutting operation. To accomplish this, the marine swivel seal extractor must land on a fixed point in the marine riser, blowout preventer, or subsea wellhead. For cutting larger casing strings, after the riser has been removed, adapter rings can be added to the marine swivel seal extractor. The addition of the hanger seal extractor, which replaces the adapter ring and blank bottom, enables this tool to extract the hanger seal assembly from a subsea wellhead.

The marine swivel seal extractor lands onto an intermediate casing hanger in an 183/4-in. (476.3-mm) subsea wellhead. The integral seal extractor snaps into the casing hanger seal assembly when landed. To operate effectively in either application, a slack joint or long-stroke bumper jar should always be run above the marine swivel seal extractor. This eliminates premature movement of the swivel and also reduces the drillstring flex to prevent an uneven cut. After the intermediate casing string is cut, the casing hanger seal is released with a straight pull. A ring-type spaceout assembly is run below the swivel so the cutter is positioned at the desired cutting depth if knife changes need to be made.

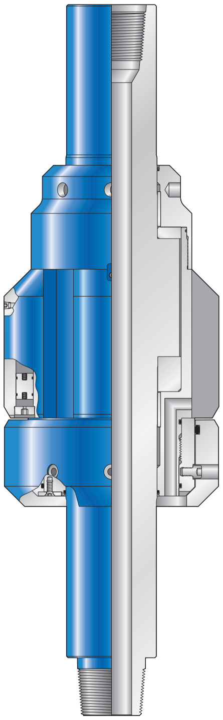
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about positioning a cutter with pinpoint accuracy in a volatile offshore environment using the Baker Hughes marine swivel seal extractor.

Applications

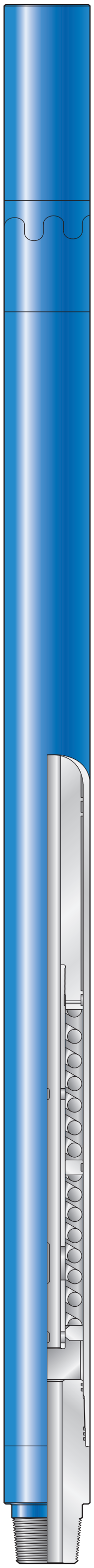
- Suspend a cutting string in a fixed vertical position
- Floating rigs

Features and Benefits

- Specially designed profile
  - Enables pinpoint accuracy for the repositioning of a cutter
- Heavy-duty bearings
  - Release and recover the casing hanger seal assembly
- Hanger seal extractor
  - Adapts easily to retrieve any straight pull-release seal assembly
- Adapter rings
  - Enable cutting larger casing strings



Marine swivel with blank bottom
Product family no. H17002



RatPACK™ retrievable packer impulse tool
Product family no. H14070

RatPACK Retrievable Packer Impulse Tool

Recover items stuck downhole with low impact and low risk

The Baker Hughes RatPACK™ retrievable packer impulse tool can recover a fish in just a few minutes. Unlike jars, which create high impacts on the fish, the RatPACK tool creates low-frequency upward-impact impulses on items that are friction-point or sand-stuck. The RatPACK tool fills the gap between jars, which can hit only every minute or two with high impacts and surface vibrators. Surface vibrators such as jars have limited effectiveness in retrieving point-stuck equipment and in deviated or horizontal wells.

The RatPACK runs on a bottomhole assembly directly above an engaging device to remove retrievable packers and point-stuck equipment that cannot be pulled free. Some instances where the packer cannot be freed include when junk or sand is on top of the packer; the wellbore is deviated; and when there are limitations of the workover rig, workstring, or production tubing. In most cases, jarring from the surface only causes the packer to become stuck tighter or jars the mandrel out, causing the packer to be recovered by washing over.

The tool operates by flow rates. When the flow rate is changed, the impulse rate varies directly.

Tool operation is independent of overpull. High or low overpulls can be applied while the tool is operated, making the RatPACK tool ideal for high-angle or horizontal wellbores. The tool does not require drill collars or high-strength workstrings, and uses clear fluid types such as water, brine, or calcium chloride

Because the impulses caused by the RatPACK tool rattle and shake the packer free, in contrast to the high-load impacts seen with jarring strings, using the RatPACK tool is the preferred method of recovering stuck retrievable packers and point-stuck equipment.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how our RatPACK tool can help you recover items stuck downhole with low impact and low risk.

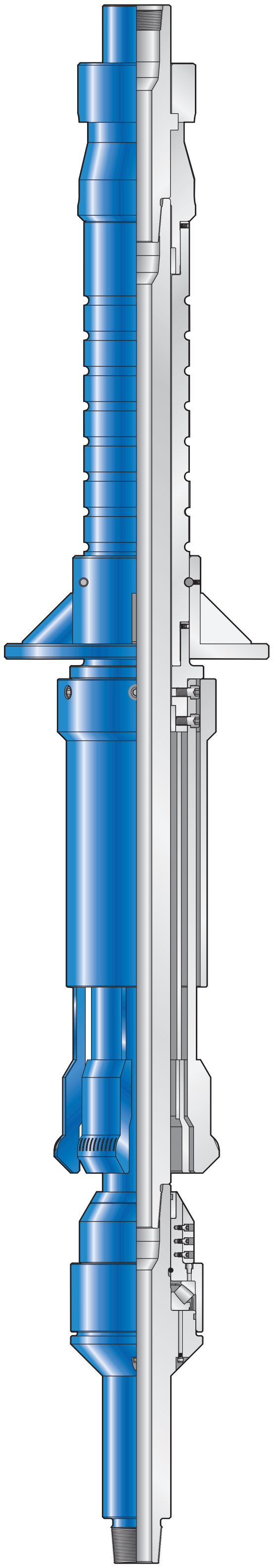
Applications

- Sand-stuck, friction-point-stuck, or gravel-pack-liner recovery operations
- High-angle, deviated, and horizontal wells
- For operations at flow rates between 1 bpm–3 bpm (159 lpm–477 lpm)

Features and Benefits

- Fast impulses compared to cycling jars
  - Reduce load factors on the workstring and service rig
- Operation is independent of overpull or set-down loads
  - Does not need to run drill collars
  - Does not need high-tensile workstring
  - Can be torqued and jarred through and operates with any engaging device
- Quicker operation time compared to jars
  - Saves rig time

Specialty Tools



Universal wellhead retrieving system
Product family no. H12215

Universal Wellhead Retrieving System

Retrieve any manufacturer's subsea wellhead in a single trip

The Baker Hughes universal wellhead retrieving system runs in conjunction with a multistring cutter capable of severing multiple strings of casing to remove any subsea wellhead from the sea floor. It can be adjusted easily, so that a wellhead made by any manufacturer can be engaged and lifted by this universal retrieving system.

The system consists of an adjustable lift lug assembly and landing collar positioned on an inner mandrel. The lifting mechanism is supported on the mandrel by a thrust bearing that permits the mandrel to rotate, which in turn rotates the multistring cutter mounted on the bottom of the mandrel.

The lift lug assembly engages an internal upset in the wellbore. This technique provides positive engagement and eliminates reliance on the penetration of wickers into the inside diameter of the wellhead. Lift-lug-engaged diameter is controlled with interchangeable sleeves. The depth of lift lug position in the wellhead is controlled by adjusting the placement of the landing collar.

The stabilizer, multistring cutter, ring-type spaceout assembly, necessary pup joints or pony collars, and bumper jar are made up below the universal wellhead retrieving system for correct cutting depth. Longstroke bumper jars or slack joints are made up on top of the tool, which is run in the well in the release position. The top of the wellhead is slowly tagged with landing ring, and ¼-in. round of left-hand torque is applied at the tool. 50,000 lb to 300,000 lb (22 679 kg to 136 080 kg) is pulled over the workstring weight. Rotating torque is established, and recommended pump pressure is slowly applied as needed to operate the multistring cutter. Cutting continues until the pipe is cut.

If the operator is unable to cut the pipe and needs to disengage the universal wellhead retrieving system, operations can be slacked off until the J-lug engages the J-slot. Slight right-hand rotation may be needed. After the J-slot is engaged, the system is picked up. This action puts the tool in the release position and the operator can now pull the tool out of hole.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to discover how our universal wellhead retrieving system can cut casing and lift any manufacturer's subsea wellhead in one trip.

Applications

- For removing a subsea wellhead from the sea floor

Features and Benefits

- Easily adjusted
  - Catches wellheads of all manufacturers
- Keeps workstring in tension while cutting
  - Does not damage sealing areas
- Quick operation
  - Takes one trip to cut casing and recover wellhead

Accessory Tools

Casing Jack System

Drilling Safety Joint

J-Type Safety Joint

Lead Impression Block

Ring-Type Space-Out Assembly

Sleeve-Type Non-Rotating Stabilizer

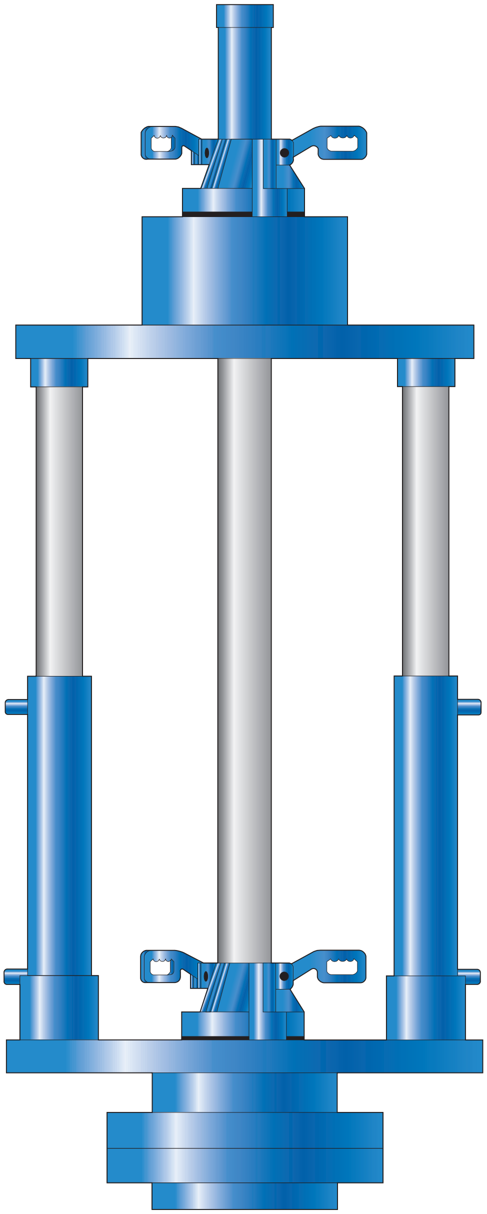
Triple-Connection Bushing

True-Circle Tong Bushing

Variable Blade Stabilizer

Washover Backoff Safety Joint

Accessory Tools



Casing jack system
Product family no. H18556

Casing Jack System

Free stuck casing or reset casing without pulling on rig or substructure

The Baker Hughes casing jack system is used to help free stuck casing in well abandonment jobs. It pulls enough pipe to lower the overpull, allowing the rig to finish pulling the casing out of the hole. On jobs where casing is rehung in the wellhead, the casing jack system provides the pull force necessary to reset the casing hanger at the original tension at which the casing was run, regardless of the type of rig on the well. Most systems have a combined lifting ratio of 100:1 and a 6,000 psi (413.7 bar) pressure lift capacity, which translates to 600,000 lb (2 72 160 kg) of total weight lift capacity.

After the casing jack system is set up and the manifold is connected, a casing spear and drillpipe pup joint are made up and inserted into the top of the casing. The spear is set with enough of the pup joint sticking up to set the top set of slips. With upper and lower slips in place, the jacks are slowly cycled and the casing jack system is picked up in the wellhead. When the casing hanger is high enough above the bottom-slip area, the bottom slips are set and the casing hanger is removed.

For rehanging jobs, the casing hanger is replaced and the casing jacks are removed when tension is applied. For abandonment jobs, jacking continues until the casing is free enough for the rig to pull.

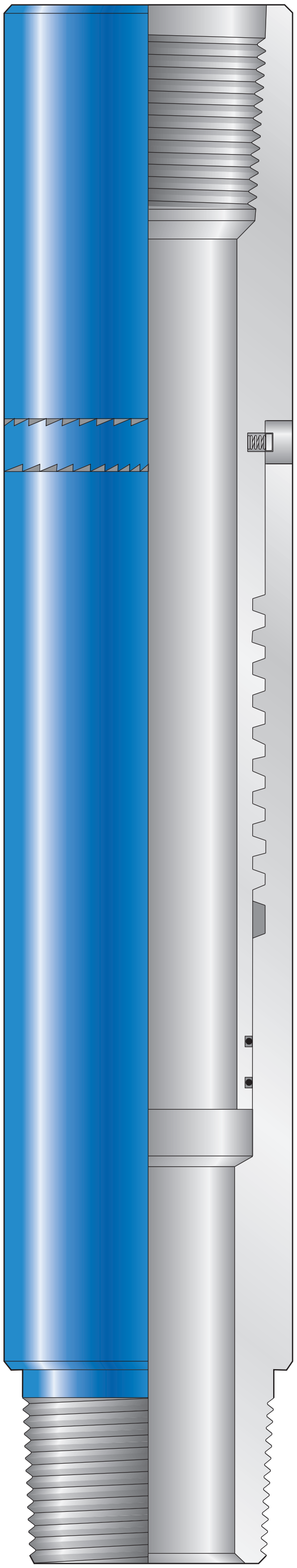
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes casing jack system can free stuck casing or reset casing without pulling on rig or substructure.

Application

- To free stuck casing when wells are abandoned
- To reset casing hangers when casing is rehung in the wellhead

Features and Benefits

- Pulls against top of wellhead flange instead of rig derrick or substructure
  - Improves performance
  - Reduces risk
- Accepts API casing handling equipment
  - Increases flexibility
- High-pressure power unit operates a closed hydraulic system
  - Eliminates need for an external pump



Drilling safety joint
Product family no. H15025

Drilling Safety Joint

Retrieve workstring and disconnect easily from a BHA

The Baker Hughes drilling safety joint provides a means of disconnecting the workstring from the bottomhole assembly (BHA) or a nonreleasable engaging tool without the use of wireline or a manual backoff. It can easily be made up, released, and reengaged while still engaging in all normal operations.

The drilling safety joint consists of a top half, friction ring, and lower half. Spring-loaded pins keep the friction ring attached to the top half. The friction ring keeps the safety joint from unscrewing during normal operations, and permits transmission of full torque in the makeup direction but considerably less torque in the release direction. O-rings seal off both internal and external pressure. When needed, the drilling safety joint easily releases to retrieve the workstring above it.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes drilling safety joint retrieves workstring and disconnects easily from a BHA.

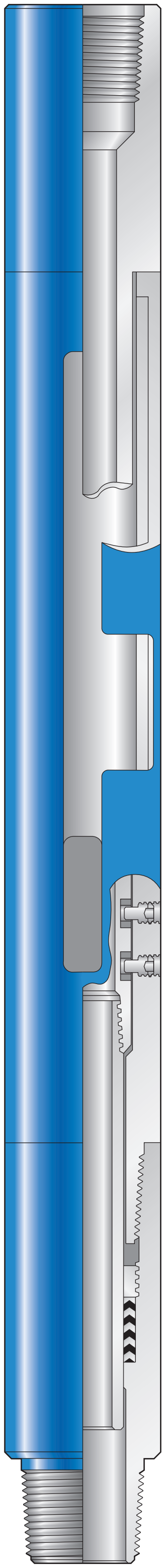
Application

- To retrieve string above the joint if tools below become stuck

Features and Benefits

- Simple design and construction
  - Improves performance
  - Reduces risk
- No shear pins
  - Reduces risk by providing means of removing workstring
- Internal thread
  - Backs out at lower torque value than workstring to reduce risk of backing out at undesirable location in string
- Can be manufactured with nonmagnetic materials for use near measurement-while-drilling tools
  - Increases tool's applicability to oilfield operations

Accessory Tools



J-Type™ safety joint
Product family no. H14037

J-Type Safety Joint

Save rig time and reduce risk during release and re-engagement of fishing tools

Baker Hughes J-Type™ safety joint provides a simple, yet effective means of releasing and re-engaging fishing tools, particularly those such as taps or die collars that are normally not releasable. J-type safety joints can be used as backoff connectors on washover jobs to save rig time by connecting to the washed-over fish while the washover pipe is in the hole. Accessory parts such as a packoff sub and two different stingers are available for operations that require circulation through the safety joint to the fish.

The J-type safety joint is a two-piece unit that is secured when lugs on the top half engage with a J-slot on the bottom half. Special shear screws keep the tool securely fastened until the fish is engaged, and then a 10,000-lb (4536-kg) tension load per screw is applied to the string. When the screws have been sheared and the tension released, the string is elevated while slight left-hand torque is applied. The lugs then shift into the release slot and the two halves of the safety joint separate.

To reengage the safety joint, the string is lowered while rotating until the lugs on the top half engage the slots in the lower half. Rotation is stopped, torque is maintained, and the string is lowered until the joint is fully engaged. The joint remains engaged until the releasing procedure is repeated.

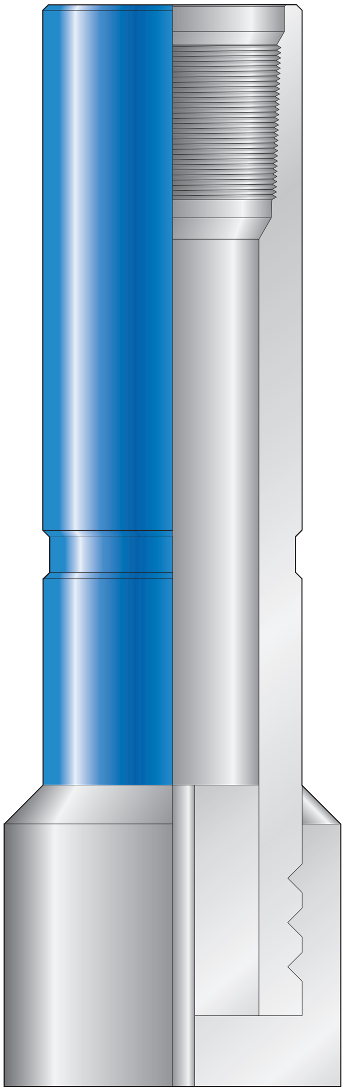
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can save rig time while releasing and re-engaging fishing tools with our J-Type safety joint.

Application

- Release fishing tools
- Re-engage fishing tools

Features and Benefits

- Shear screws
  - Prevent accidental unlatching before engaging fish
  - Reduces risk
- Simple construction
  - Allows easy makeup and release
- Constructed from AISI 4140 heat-treated alloy steel
  - Increases robustness
  - Lowers risk



Lead impression block
Product family no. H14106

Lead Impression Block

Determine fish condition and position to improve retrieval operations

The Baker Hughes lead impression block is used to get an imprint of the top of a fish to determine its condition and position. This helps guide the operator in retrieving the fish from the the well, and is especially useful when not much is known about the fish downhole.

The block can be run on wireline, coiled tubing, or drillpipe. Weight is then set down onto the block and fish, and the block is pulled out of hole and inspected by the fishing tool operator. The head of the block is constructed of cast lead, a soft material that was selected to ensure a good impression.

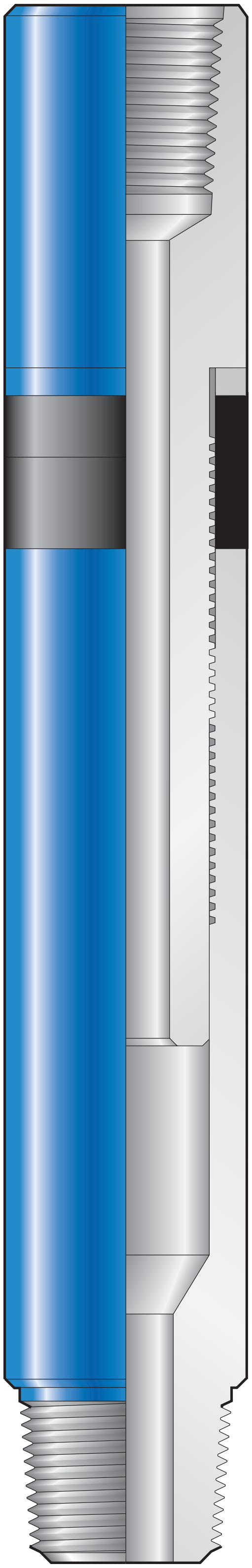
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes lead impression block can help you improve your retrieval operations.

Application

- Fishing operations

Features and Benefits

- One-piece construction with a cast lead head
  - Ensures reliability
  - Receives imprint of fish easily
- Can be reworked for multiple runs
  - Saves on cost
- Available in many sizes
  - Offers a wide range of impression possibilities



Ring-type space-out assembly
Product family no. H17035

Ring-Type Space-Out Assembly

Accurately reposition multistring cutters after knife changes

The Baker Hughes ring-type space-out assembly is used to accurately reposition the cutter after the required knife changes, mostly when cutting three or four strings of casing are positioned eccentrically while running the multistring cutter on floating platforms. It is used primarily with the multistring cutter and the marine swivel. When the space-out assembly is adjusted with the required knife change, the cutter can be precisely repositioned so the new knives swing into the window in the casing created by the previous cut.

The assembly consists of 1-in. (25.4-mm), 2-in. (50.8-mm), and 3-in. (76.2-mm) spacer rings and 8-in. (203.2-mm) and 12-in. (304.8-mm) shoulder-to-shoulder-length subs. This allows the total length to vary in 1-in. increments from over a 26-in. (660.4-mm) range. Depending on casing sizes to be cut and knife changes made on the multistring cutter, the fishing supervisor takes out necessary rings or subs as required.

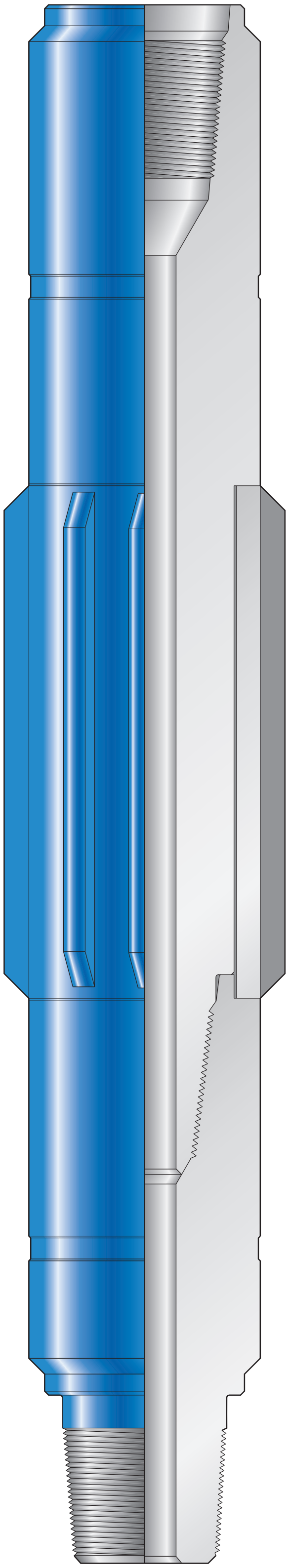
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes ring-type space-out assembly can help you accurately position cutters after knife changes.

Application

- To reposition the cutter
- Deep water
- Floating platforms

Features and Benefits

- Simple design and operation
  - Reduces risk
  - Lowers maintenance requirements
- Allows pinpoint accuracy for repositioning cutter
  - Improves performance of operations



Sleeve-type non-rotating stabilizer
Product family no. H17130

Sleeve-Type Non-Rotating Stabilizer

Ensure smooth and efficient rotation in cutting, milling, and fishing operations

The Baker Hughes sleeve-type non-rotating stabilizer provides maximum centralization and ensures smooth and efficient rotation in cutting, milling, and fishing operations. It is composed of a mandrel, sleeve, and bottom sub, and is run with other fishing tools to centralize a small-outside-diameter fishing tool in a larger sized hole.

The stabilizer is normally run in the string immediately above the fishing assembly. Two stabilizers are recommended to improve centralization.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes sleeve-type nonrotating stabilizer can ensure smooth and efficient rotation.

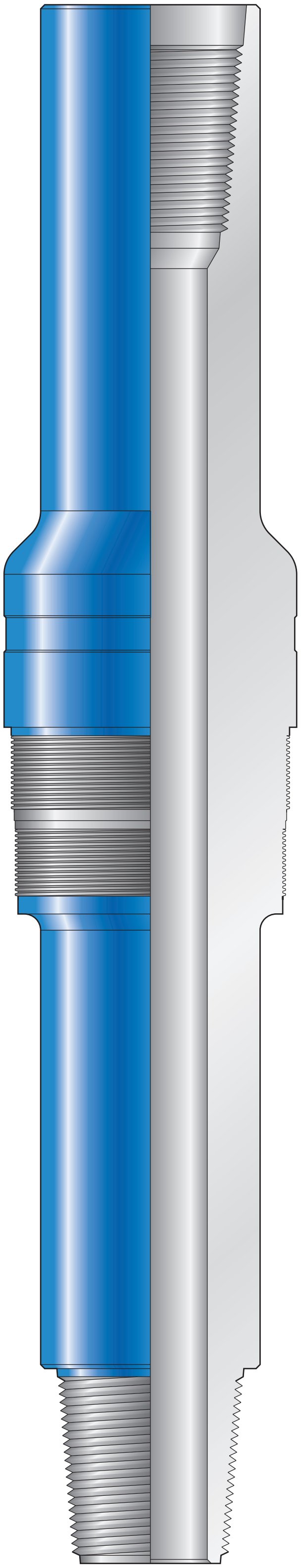
Application

- To smooth the rotation of fishing tools

Features and Benefits

- Reduced shock load on cutter knives
  - Ensures longer cutting life
- Sleeves available for 4½-in. (114.3-mm) to 20-in. (508.0-mm) casing
  - Meets the needs of most wells

Accessory Tools



Triple-connection bushing
Product family no. H14025

Triple-Connection Bushing

Provide an inside and outside assembly for a BHA

The Baker Hughes triple-connection bushing is used for any bottomhole assembly (BHA) requiring an inside and outside assembly, and is generally run in conjunction with a backoff or packer retrieving assembly. It consists of three connections: a washpipe connection and two drillpipe connections.

Its outside diameter is built in accordance with specifications of the washpipe connection and the inside diameter (ID) is determined by API specifications of the smaller drillpipe connection.

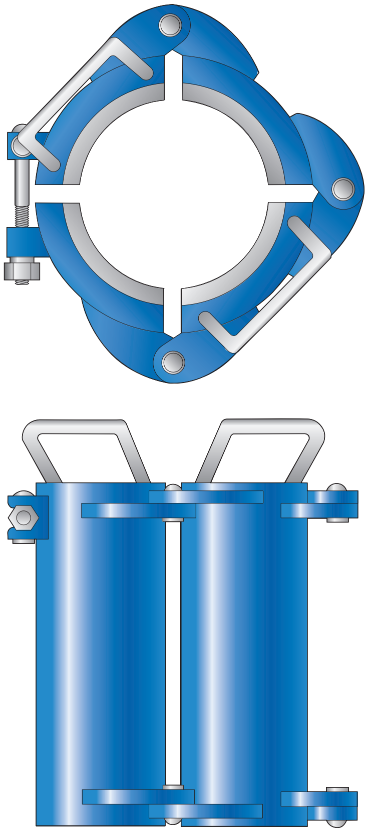
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes triple-connection bushing can be used for a BHA requiring an inside and outside assembly.

Application

- For a BHA needing an inside and outside assembly

Features and Benefits

- One-piece construction
  - Ensures reliability
- Any size and combinations can be ordered
  - Adds flexibility
- Large enough ID for backoff shots to pass through
  - Improves performance



True-Circle tong bushing
Product family no. H18056

True-Circle Tong Bushing

Protect tubulars from damage during makeup or breakout

The Baker Hughes true-circle tong bushing protects tubulars such as washpipe from being mashed when they are made up or broken out by rig tongs.

Use of the tong bushing is simple. The true-circle tong bushing is wrapped around the tubular and a latch bolt is placed into the slotted latch holder. Next, the latch nut is tightened. The tongs are placed on the true-circle bushing only and the connection is tightened to the recommended makeup torque. The bushing can then be removed.

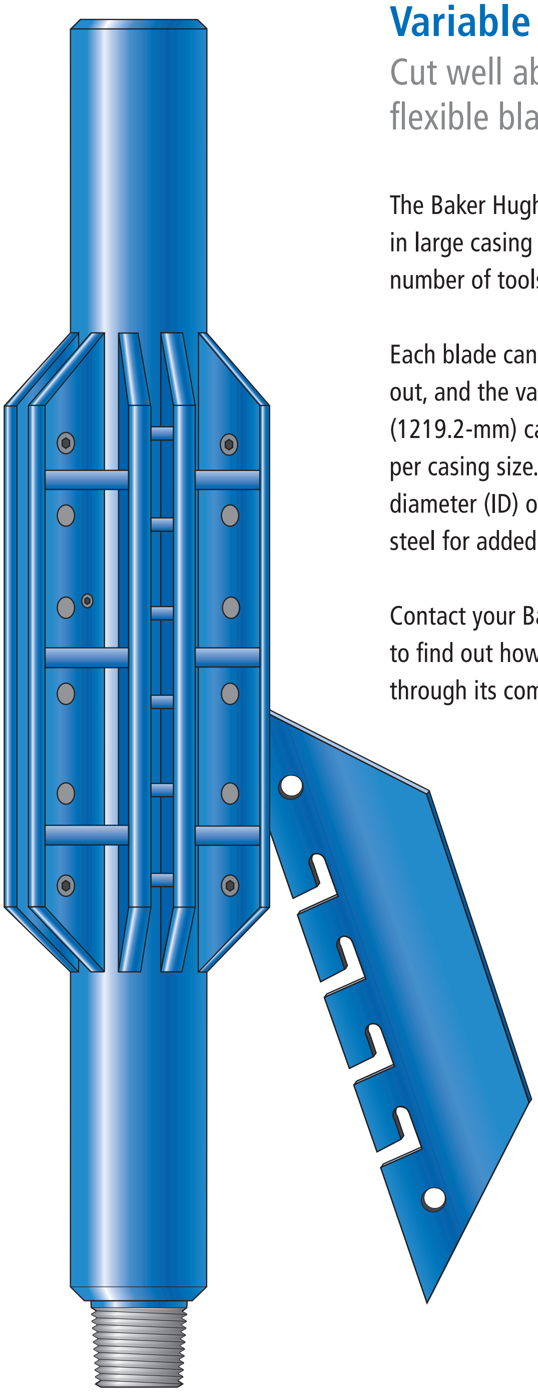
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes true-circle tong bushing can help you protect tubulars from damage.

Application

- Prevent mashing of tubulars

Features and Benefits

- Simple operation and rugged construction
  - Reduces risk
- Wraps around pipe's outside diameter in a true circle
  - Distributes torque evenly
- Unique safety design
  - Reduces or eliminates tong damage on thin wall tubulars and washpipe
  - Keeps tubulars from being mashed



Variable blade stabilizer
Product family no. H17030

Variable Blade Stabilizer

Cut well abandonment expenses with compact, flexible blade system design

The Baker Hughes variable blade stabilizer runs above multistring cutters or milling tools in large casing sizes without restrictions. Its unique, compact design ultimately reduces the number of tools required for well abandonment operations, reducing expenses all around.

Each blade can be easily changed by removing two locking pins and lifting the blades up and out, and the variable blade stabilizer can be dressed to stabilize in 16-in. (406.4-mm) to 48-in. (1219.2-mm) casing. The variable blade stabilizer comes equipped with five replaceable blades per casing size. The blades are manufactured of mild steel to minimize damage to the inside diameter (ID) of the casing. The body is a single unit manufactured from 4140 heat-treated alloy steel for added robustness.

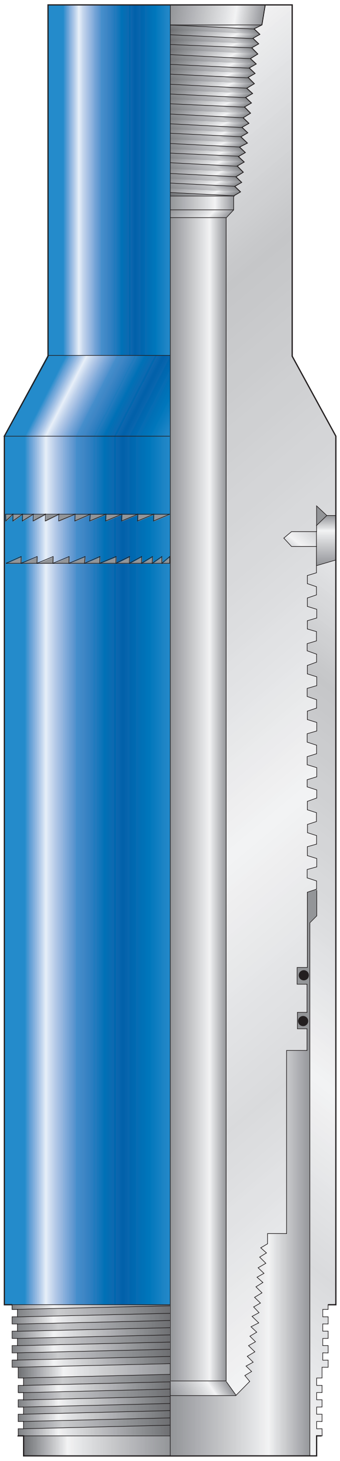
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes variable blade stabilizer can cut well abandonment expenses through its compact, flexible blade design.

Application

- Land and offshore well abandonment operations
- Blades for casing cutters or mills

Features and Benefits

- Reduced equipment required for well abandonment
  - Lowers equipment cost and operating time
- Easily converted to different casing sizes
  - Adds flexibility
  - Saves time and expense
- Can be economically modified for special ID casing
  - Reduces expense
  - Meets needs for unique conditions



Washover backoff safety joint
Product family no. H14038

Washover Backoff Safety Joint

Wash over, back off, and recover fishing string in one trip

The Baker Hughes multipurpose washover backoff safety joint is used to wash over a stuck string, screw into the fish, and perform a backoff, all in one trip. After the fish is screwed in and it has been established that it cannot be pulled, the J-Type™ safety joint can be released to allow the washpipe to reciprocate and rotate. The washover safety joint is run in conjunction with the Baker Hughes J-Type safety joint in washover and backoff situations.

The washover backup safety joint can be installed in the washover string in place of the washpipe drive sub, and can be used like standard drilling safety joints. In case a washover string gets stuck, the washover backoff safety joint can easily be backed off from the surface so the fishing string above the washpipe can be recovered.

After a string shot has been run just above the J-Type safety joint, the fish can be re-engaged and backed off. If the washpipe does not turn freely to the left, the anti-friction ring of the washover safety joint will allow this point to unscrew. The long threaded area makes it possible to back off all tool joint connections and most tubing connections without completely unscrewing the washover safety joint.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes washover backoff safety joint can help you wash over, back off, and recover fishing string in one trip.

Application

- Washover, backoff, and fishing operations
- To recover washover string when a fish cannot be pulled

Features and Benefits

- Available in many washpipe and tool joint connections
  - Meets requirements for most situations
- Can be used as standard washover safety joint
  - Adds flexibility
- Simple design and operation
  - Eases use
  - Reduces risk

Notes

Whipstock Systems, Anchors, and Retrieving Tools

Whipstock Systems, Anchors, and Retrieving Tools Guide

EXCLUDER Sub

Fixed Lug Whipstock Retrieving Tool

Hydraulic-Set PathMaster and Hydraulic WindowMaster G2 Whipstock Systems

Hydraulic Setting Module and Adapter Kit for TorqueMaster Whipstock Packer

Hydraulic Whipstock Valve

PathMAKER Formation Mill

PathMaster Whipstock System

Retrievable Anchor and Packer Bore Cleanout Tool for Permanent TorqueMaster Packer

Retrievable TorqueMaster Packer

Shear-Type Disconnect

SilverBack Window Mill

Special Taper Box Tap for Retrieval of WindowMaster Whipstock

TorqueMaster Bottom-Trip Retrievable Anchor

TorqueMaster Hydraulic-Set Retrievable Anchor

TorqueMaster ML Packer

TorqueMaster Permanent Packer and Removable Anchor

Unloader Valve

WindowMaster G2 Whipstock System

Openhole Whipstock System

BigFoot Openhole Whipstock Anchor

Retrievable Inflatable Whipstock Anchor

BAKER HUGHES

Whipstock Systems, Anchors, and Retrieving Tools Guide

Whipstock systems are used to sidetrack a wellbore for many reasons, including re-entry of an existing wellbore, drilling a bottomhole assembly that has become stuck and is too costly to fish out, severe formation or drilling problems, the need to change the direction of a wellbore, or the need to drill multiple exits from a single wellbore.

Whipstock systems are available in both permanent and retrievable versions, with three retrieval tool options to accommodate even severe hole conditions. Whipstock systems produce a kickoff point with exact depth control and a precise direction. A complete system includes a whipstock orientation device, anchoring device, and a milling system.

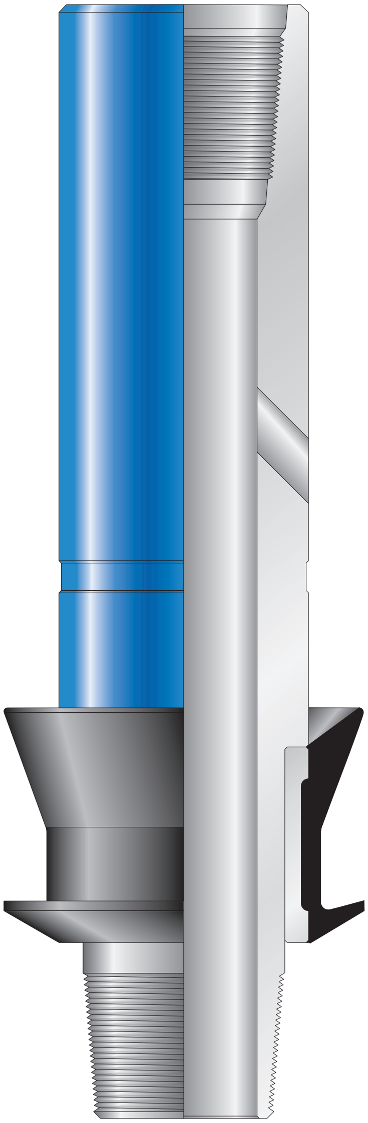
Dual-string exits have now become commonplace and triple-string exits are also often completed successfully. Recent advances in directional drilling technology, combined with advances in whipstock technology, have sparked a substantial increase in sidetracks from existing wellbores.

A sidetrack from an existing wellbore can normally be completed for two-thirds the cost or less compared to a new well. Baker Hughes has led the industry with new products in this area, such as the one-trip WindowMaster™,WindowMaster G2™, PathMaster™, and TorqueMaster™ anchoring systems.

Whipstock Application Chart

Whipstock System	Anchoring Methods	Orienting Methods	Activation Methods
WindowMaster™ whipstock system WindowMaster G2™ whipstock system PathMaster™ one-trip system	Retrievable TorqueMaster™ bottom-trip anchor	Measurement-while-drilling or gyroscopic	Set on bottom, bridge plug, liner top or restriction
	Permanent TorqueMaster packer/anchor		
	Retrievable TorqueMaster packer		
	ML TorqueMaster packer/anchor		Hydraulic/drillpipe set
	ML ZX™ liner hanger/packer		*Wireline set for TorqueMaster packer
	Retrievable TorqueMaster hydraulic-set anchor		

**Whipstock requires additional run*



EXCLUDER™ sub
Product family no. H15038

EXCLUDER Sub

Ensure efficient operations by preventing debris accumulation

Baker Hughes uses the EXCLUDER™ sub when a planned whipstock retrieval operation will occur. The EXCLUDER sub prevents debris from getting around the anchor or packer assembly to ensure trouble-free operations. The primary EXCLUDER sub is typically the first tool located just below the whipstock, followed by other whipstock accessories including the unloader valve and shear disconnect. A second EXCLUDER sub can be included and placed directly above the anchor or packer as an optional back-up barrier to prevent any residual debris from falling down during washover or retrieval operations.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices for more information on using our EXCLUDER sub to ensure efficient operations by preventing debris accumulation.

Applications

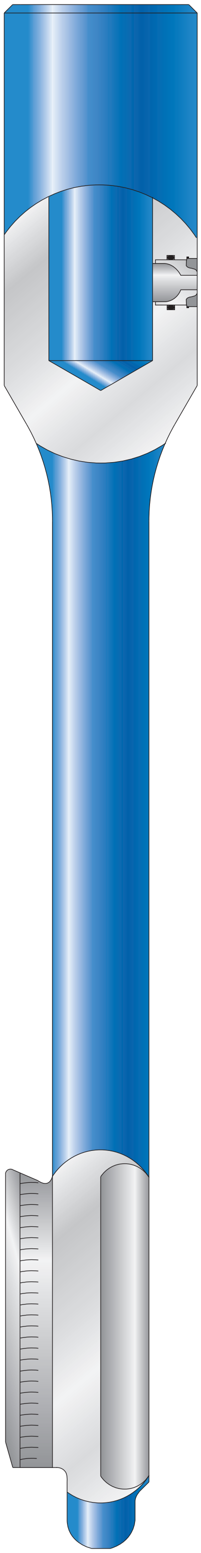
- To keep debris away from the anchor or packer assembly

Features and Benefits

- Universal configuration
  - Runs on all whipstock systems
- Ported model
  - Prevents swabbing during retrieval
- Non-ported model
  - Can be used with hydraulic setting tools

Fixed Lug Whipstock Retrieving Tool

Retrieve whipstock with safe, robust, reliable tool



Fixed lug whipstock retrieving tool
Product family no. H15051

The Baker Hughes fixed lug retrieving tool provides a safe, reliable way to engage WindowMaster™ whipstocks or PathMaster™ whipstocks and remove them from the wellbore. Design features ensure that the lug can be re-engaged repeatedly as needed, and that the whipstock cannot be dropped while it is being pulled out of hole.

Baker Hughes recommends using the fixed lug retrieving tool as the primary method because it can release from the whipstock at any given point and then re-engage as needed.

For retrieving a whipstock, the preferred bottomhole assembly includes the fixed lug retrieving tool, jars, and drill collars. The lug is lowered to the correct measured depth and slowly reciprocated up and down, and can be oriented.

If the lug does not engage, the workstring should be turned and reciprocated up and down again. This process can be repeated until the lug engages. The lug can also be run with orientation tools such as MWD or gyro. After the lug engages, the whipstock can be retrieved by releasing the anchor or packer below. Set-down weight can be applied without disengaging if the jars need to be recocked. The fixed lug can be released by applying a small amount of right-hand torque and lowering the lug through the neutral point.

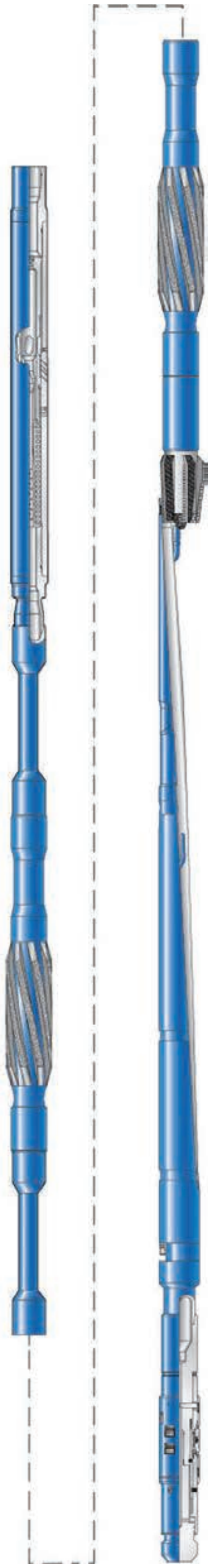
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to discover more about the safe, robust, reliable features of the Baker Hughes fixed lug whipstock retrieving tool and how it can be used to retrieve whipstocks.

Applications

- For removing Baker Hughes whipstock systems from the wellbore

Features and Benefits

- Strong and durable with solid body construction
  - Can be easily disengaged and re-engaged multiple times
  - Will take weight for cocking fishing jars if necessary
- Jet at top of tool
  - Enables cleaning of retrieving slot
- Dovetail slot
  - Prevents dropping whipstock while pulling out of hole



Hydraulic-set PathMaster™ and WindowMaster G2™ whipstock systems

Hydraulic-Set PathMaster and Hydraulic WindowMaster G2 Whipstock Systems

Add one-trip capability to many tools with hydraulic activation

The hydraulic-set PathMaster™ and hydraulic WindowMaster G2™ whipstock systems enable the use of hydraulically-activated anchor and packer systems with proven one-trip whipstock systems. These systems provide a secure hydraulic communication link to below the whipstock, which enables whipstock anchoring devices to be hydraulically activated and set and the casing window milled in one trip.

A production injection packer or TorqueMaster™ hydraulic-set retrievable anchor can be activated and set directly. In addition, a TorqueMaster permanent packer and removable anchor or retrievable TorqueMaster packer can be activated and set using the hydraulic setting module and adaptor kit.

When run with the hydraulic whipstock valve and any of the abovementioned anchoring systems, the hydraulic-set PathMaster and WindowMaster G2 whipstock systems can be run and oriented using measurement-while-drilling (MWD) tools or wireline gyro survey tool, hydraulically anchored in place, and have the casing exit milled in one drillpipe trip. This eliminates any drillpipe or wireline trips associated with setting a bridge plug or whipstock packer before running the whipstock. Window milling performance is identical to the non-hydraulic versions of the PathMaster and WindowMaster G2 whipstock systems, and when run with retrievable anchors, whipstock retrieval is also the same.

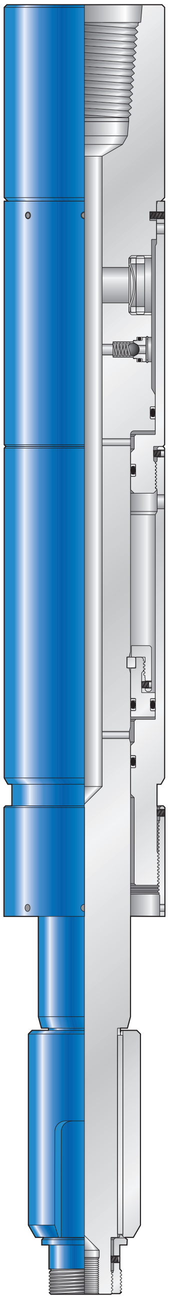
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn how our hydraulic-set PathMaster and hydraulic WindowMaster G2 whipstock systems can add one-trip capability to many tools with hydraulic activation.

Applications

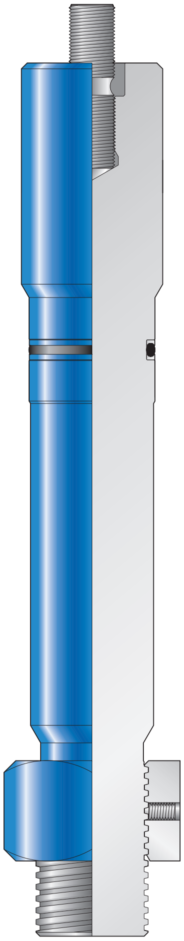
- To hydraulically activate whipstock anchoring devices

Features and Benefits

- PIP or TorqueMaster hydraulic-set retrievable anchor
  - Can be activated and set directly
- TorqueMaster permanent packer and removable anchor or retrievable TorqueMaster packer
  - Can be activated and set using the hydraulic setting module and adaptor kit
- Hydraulic-set PathMaster and WindowMaster G2 whipstock systems
  - Can be run and oriented using MWD drilling tools or wireline gyro survey tool
  - Can be hydraulically anchored in place
  - Can have casing exit milled in one trip



Hydraulic setting module
Product family no. H41584



Adapter kit for the TorqueMaster™ whipstock packer
Product family no. H41583

Hydraulic Setting Module and Adapter Kit for TorqueMaster Whipstock Packer

Set the packer for a one-trip milling operation

The Baker Hughes hydraulic setting module and adapter kit are used to set the TorqueMaster™ packer hydraulically without the need for preliminary trips to set a restriction plug for mechanical activation. The TorqueMaster packer is run in hole with the hydraulic setting module, adapter kit, and whipstock milling assembly. It can achieve orientation, hydraulically set the whipstock, and cut the window, all in one trip.

The hydraulic setting module sets the TorqueMaster packer with applied pressure to the tubing. A measure-while-drilling (MWD) bypass valve and special WindowMaster™ whipstock and starter mill are required to set the hydraulic setting module. The module and kit are rated to 20,000 ft-lb (27.1 kNm) torque and can withstand up to 15,000 psi (1034.2 bar) hydrostatic pressure.

The packer can be washed over and retrieved in one trip with packer milling retrieval tools, leaving minimal equipment in hole to wash over. The setting module and whipstock can be retrieved even if packer cannot.

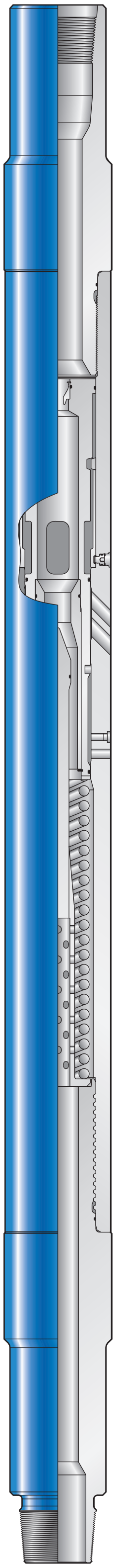
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to discover how our hydraulic setting module and adapter kit for the TorqueMaster whipstock packer can set the packer for a one-trip milling operation.

Applications

- Sets a packer in a cased hole for sidetrack operations

Features and Benefits

- True one-trip hydraulic application
  - Eliminates need for restriction for mechanical activation
  - Allows whipstock to be oriented and set so window can be milled
- Burst disc
  - Provides visual indication at surface when the packer is set
- All seals can be tested
  - Ensures reliability



Hydraulic whipstock valve
Product family no. H15036

Hydraulic Whipstock Valve

Integrate functions of hydraulic equipment for efficient operations

The Baker Hughes hydraulic whipstock valve allows normal circulation, drillstring fill-up, and measurement-while-drilling (MWD) operation while the WindowMaster™ whipstock system is being run. The valve allows integration of field-proven systems: it works with any Baker Hughes hydraulic-set anchor, or TorqueMaster™ packer in conjunction with hydraulically-operated equipment run above the whipstock.

The whipstock valve allows for MWD whipstock orientation of hydraulic systems, on-command closure of flow to the annulus, setting the packer, and complete milling of the casing with one trip of the drillpipe. The valve is actuated hydraulically by varying the flow rate in the drillpipe. Manipulation of the drillstring is not required. Internal pressures above and below the valve are equalized relative to the annulus to prevent accidental actuation caused by differential pressure across the valve. The valve will shift at a flow rate considerably higher than that required for normal MWD operation so the packer cannot be set accidentally during normal MWD orientation.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about how our hydraulic whipstock valve can be used to integrate the functions of hydraulic equipment for efficient operations.

Applications

- To allow circulation, drillstring fill-up, and MWD while the WindowMaster system runs
- To allow a hydraulic-set anchor, bottom-trip anchor, or TorqueMaster packer to run with hydraulic equipment above the whipstock

Features and Benefits

- Manufactured from heat-treated alloy steel
  - Allows maximum service life
- Multiple exit ports
  - Prevent valve from clogging during MWD operations
- Compression sleeve
  - Protects snap ring from contamination so valve will close reliably
- Inside diameter below valve
  - Is protected from fluid flow and debris

Whipstock Systems, Anchors, and Retrieving Tools

PathMAKER™ formation mill
Product family nos. H15157 and H15163

PathMAKER Formation Mill

Perform one-trip casing exits in extended lengths of hard and abrasive formations

The Baker Hughes PathMAKER™ formation mill was developed in conjunction with the Hughes Christensen Genesis™ bit series, and uses a special high-impact polycrystalline diamond compact (PDC) cutter to mill both formation and metal. Previously, certain hard formations required two trips to mill a window, but the PathMAKER mill can do this in one trip, saving time and money.

The PathMAKER formation mill fits both the Baker Hughes PathMaster™ and WindowMaster G2™ whipstocks to provide true one-trip casing exits and extended rathole in hard and abrasive formations such as sandstone, anhydrite, limestone, and dolomite. The PathMAKER mill features several new enhancements to improve milling and drilling performance. The specially engineered spiral-set cutter alignment reduces vibration, while the large water courses keep the PDC cutters cool for increased durability.

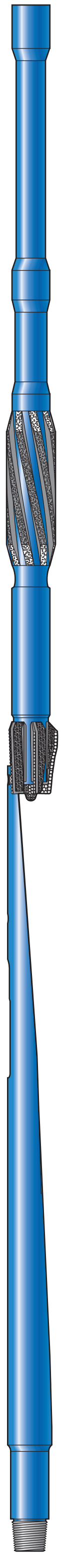
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to discover how you can mill hard formations in one trip using our PathMAKER formation mill.

Applications

- For milling windows and drilling extended ratholes in hard, abrasive formations
- For milling and cutting steel

Features and Benefits

- High-impact PDC cutter
  - Mills steel
  - Cuts hard formation casing exits in one trip
  - Mills window and can drill an extended rathole in one trip
  - Allows directional drilling to begin immediately after casing exit
- Spiral-set cutter alignment
  - Cuts smoother and cleaner
- Cutter placement
  - Controls drilling fluid to efficiently cool and clean cutter elements
- Large water courses
  - Keep cutters cool for longer life
- New mill designs
  - Are compatible with hydraulic whipstock systems



PathMaster™ whipstock system
Product family nos. H15155 (mechanical)
and H15156 (hydraulic)

PathMaster Whipstock System

Mill in one trip in short-radius wellbores with high doglegs

The Baker Hughes PathMaster™ whipstock system combines the one-trip and retrievable features of the field-proven WindowMaster™ whipstock with a shorter whipstock ramp and full-gauge mills. This system provides a quicker kickoff with a higher build rate in short-radius drilling applications. Decreased length of the whipstock and a milling assembly consisting of only a window mill and watermelon mill combine to form a significantly shorter window exit bottomhole assembly (BHA). The reduced-length BHA is capable of passing through higher doglegs in the wellbore.

The PathMaster whipstock system provides an effective means to exit casing and provide a window to run drilling BHA, liners, and completion equipment through. In one trip, the starting cut is made, the window is milled, and the rathole is drilled.

The system can be set with a Baker Hughes TorqueMaster™ packer/anchor combination or the TorqueMaster bottom-trip anchor. Orientation can be performed with measurement while drilling, universal bottomhole orientation, or gyro sensors into packer.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn how to use our PathMaster whipstock system to mill in one-trip in short-radius wellbores with high doglegs.

Applications

- Short-radius drilling
- Wellbores with high doglegs

Features and Benefits

- Full-gauge mills
  - Provide a drift window and rathole
  - Can mill casing exit and drill pilot hole in one trip
- Short whipstock ramp
  - Provides quick kickoff
- Shorter overall BHA
  - Allows system to pass through high doglegs
- Retrievable
  - Allows multiple zone applications
- METAL MUNCHER™ cutting technology
  - Cuts faster and cleaner

Retrievable Anchor and Packer Bore Cleanout Tool for Permanent TorqueMaster Packer

Reduce cleanout runs and save valuable rig time and cost

The Baker Hughes retrievable anchor and packer bore cleanout tool for the permanent TorqueMaster™ packer allows multiple stab-in and stab-out of the anchor after the packer has been set. This allows the lower zone to be produced after the anchor has been removed or allows for space out off of packer for another lateral, reducing cleanout runs and saving valuable time. The special bottom guide allows a snap-in/snap-out collet to be made up to the bottom of the packer. The packer bore cleanout tool allows the packer bore to be flushed out if debris accumulates in it. The packer with retrievable anchor has the same pressure and temperature rating as the standard TorqueMaster packer and can be conveyed by the same methods.

The TorqueMaster packer that uses the TorqueMaster retrievable whipstock anchor is a variation of the TorqueMaster packer that uses the TorqueMaster whipstock permanent packer.

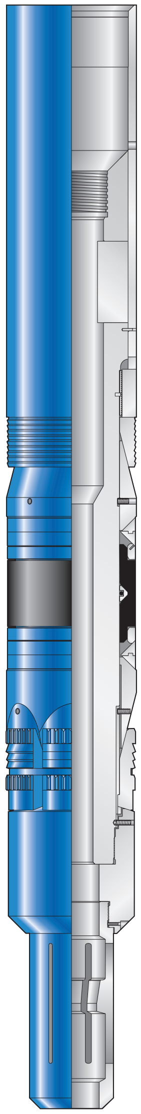
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices for more information on producing the lower zone after removing the anchor using our retrievable anchor and packer bore cleanout tool for permanent TorqueMaster packer.

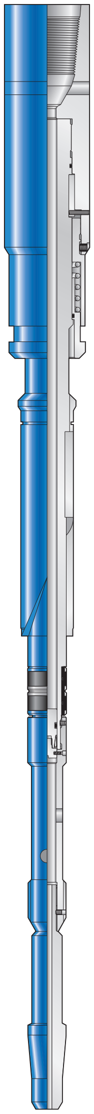
Applications

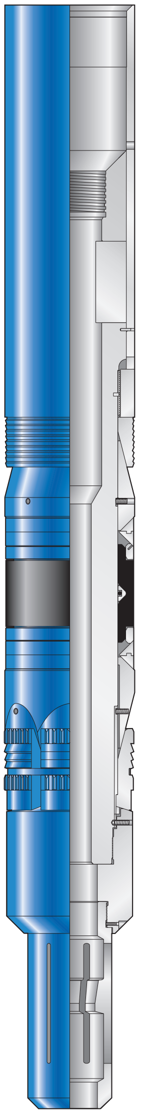
- To allow lower zone to be produced after removing the anchor
- To space out packers for another lateral
- To flush out the packer bore

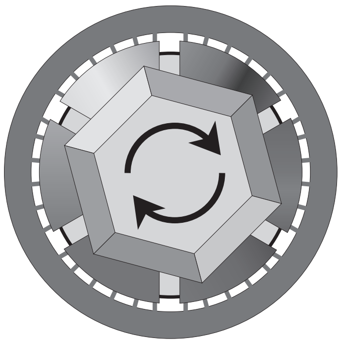
Features and Benefits

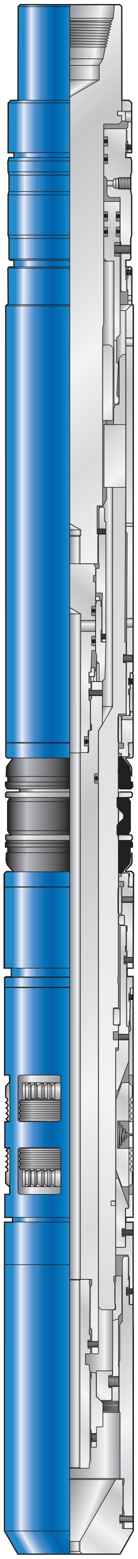
- Multiple stab-in/stab-out of anchor
  - Allows several flexible applications
- Built-in debris EXCLUDER™ screen on anchor
  - Prevents debris accumulation


TorqueMaster™ packer bore cleanout tool Product family no. H41519


TorqueMaster™ retrievable anchor Product family no. H41519


TorqueMaster™ packer Product family no. H41518


Patented cam-cone system



Retrievable TorqueMaster™ packer
(shown with setting tool)
Product family no. H64501

Retrievable TorqueMaster Packer

Orient whipstock anchor in one trip and retrieve packer

The Baker Hughes retrievable TorqueMaster™ whipstock packer orients a TorqueMaster whipstock anchor at a desired location in a cased hole for sidetrack operations, as does the field-proven permanent version, with the added benefit of one-trip, full retrievability. It is used in multilateral applications where the lower zone requires isolation during drilling of the upper zone. The system is rated for 20,000 ft-lb (27.1 kNm) of torque, 7,500 psi (517.1 bar), and 350°F (177°C) when it is run with the reliable packing element system.

The retrievable TorqueMaster packer can be run in conjunction with all WindowMaster™ and PathMaster™ one-trip window milling systems, and oriented with the measurement-while-drilling method. When run with a WindowMaster system, only one trip is required to orient the whipstock, set the packer, and mill the window. No bottom is required to activate the anchor.

After the lateral is completed, the entire system can be retrieved with one drillpipe trip. After retrieval, full-bore access to the lower lateral is restored.

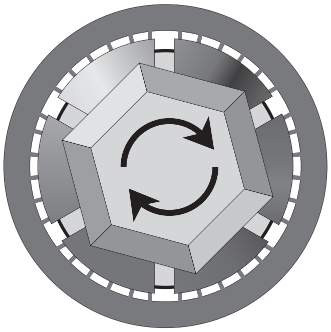
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices for more detail on using our retrievable TorqueMaster packer to orient a whipstock anchor in one trip and retrieve the packer.

Applications

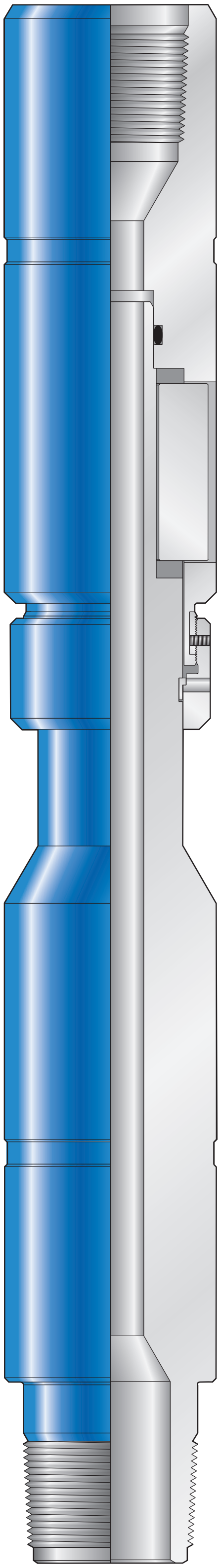
- Multilateral wells where the lower zone requires isolation during drilling of the upper zone

Features and Benefits

- Packing element above slip system
  - Prevents debris from fouling retrieval
- Retrieval system
  - Is not affected by tailpipe weight or differential pressure
- Weldless construction
  - Enhances reliability



Patented cam-cone system



Shear-type disconnect
Product family no. H14030

Shear-Type Disconnect

Retrieve a whipstock quickly and easily with reusable safety release tool

The Baker Hughes shear-type disconnect is a safety release shear joint that is run below a retrievable whipstock assembly. This tool allows the recovery of the whipstock if the anchor or packer fails to release.

The disconnect is activated by an overpull greater than the value of a user-selected shear ring. When the prescribed overpull is exceeded, the shear ring shears and the whipstock and all components above the shear-type disconnect can be recovered from the well. An external fishing neck profile remains in the well looking up.

An overshot and fishing jar can then be used to engage this profile and retrieve the remaining portion of the disconnect and the anchor or packer.

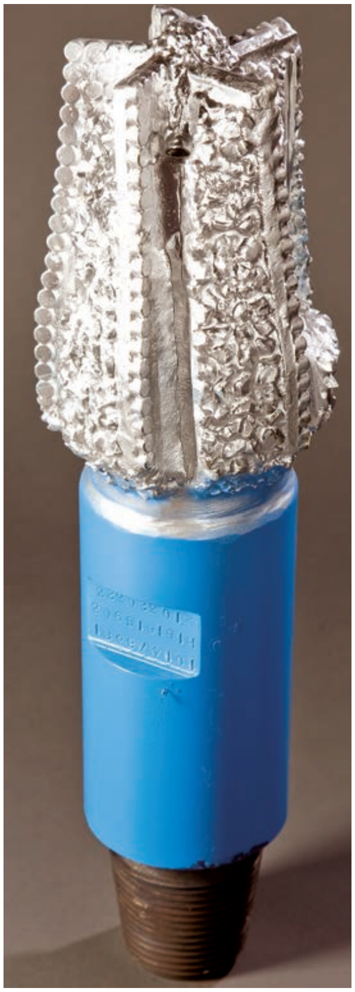
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about retrieving a whipstock quickly and easily with our reusable shear-type disconnect joint.

Applications

- Retrieve a whipstock in case of anchor or packer failure

Features and Benefits

- Allows recovery of whipstock if the packer or anchor fails to release
  - Ensures whipstock recovery even in worst-case scenarios
- Selectable shear ring size and weight values
  - Allow the same tool to be dressed for different release loads
- Rotationally locked joint
  - Withstands high torsion loads



SilverBack™ window mill
Product family no. H15161

Top view

SilverBack Window Mill

Complete a casing exit in one trip with enhanced ROP

The Baker Hughes SilverBack™ window mill provides a true one-trip casing exit in most formations. It has a full-gauge design compatible with both the WindowMasterG2™ window mills and PathMaster™ whipstocks that can mill a drift window and rathole in one trip.

Enhancements in the SilverBack window mill greatly improve milling and drilling performance, including reducing milling vibration and torque and extending METAL MUNCHER™ insert cutter life, which results in increased rate of penetration (ROP). The SilverBack window mill ROP is approximately 30% faster than the ROP of the original WindowMaster G2 window mill.

The SilverBack window mill is used with our premium casing exit systems, producing very long, full-gauge windows capable of passing large openhole completions, complex cased hole completions, and rotary steerable drilling assemblies. It is compatible with all hydraulic whipstock systems, and features easier handling while making up and breaking out the milling assembly.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn about using our SilverBack window mill to complete a casing exit in one trip with enhanced ROP.

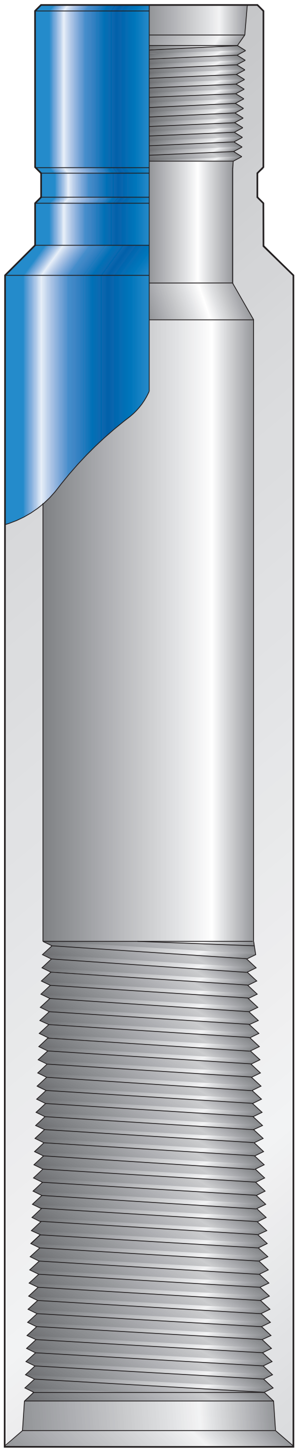
Applications

- To provide a casing exit
- For milling a drift window and rathole

Features and Benefits

- Improved mill design
  - Allows for faster cut-out time and increased ROP while milling
- Low dogleg severity at window
  - Allows directional drilling to begin immediately after casing exit is completed
- METAL MUNCHER cutters
  - Enable optimum casing milling

Whipstock Systems, Anchors, and Retrieving Tools



Special taper box tap for retrieval of WindowMaster™ whipstocks
Product family no. H11099

Special Taper Box Tap for Retrieval of WindowMaster Whipstock

Retrieve WindowMaster whipstock without damage using custom-made tool with matching profile

The Baker Hughes special taper box tap engages the WindowMaster™ whipstock so the retrievable anchor or packer can be released from the wellbore. It is specially constructed to match the upper segment of the whipstock profile so that it will not damage the whipstock face during retrieval. A special cutlip guide helps the tap engage the top of the whipstock while engaging it for retrieval. Two Baker Hughes products can be used to recover a retrievable whipstock: the fixed lug and the special taper box tap.

Baker Hughes recommends using the releasable fixed lug retrieval tool (FLRT) as the primary method of the retrieving a whipstock. In the rare case that the FLRT cannot be used, the special taper box tap is a viable option.

The recommended bottomhole assembly for whipstock retrieval includes the special box tap, safety joint, jars, and drill collars. The tool is engaged with a combination of set-down weight and rotation. The final step is to apply the torque several times to help ensure a good hold on the whipstock.

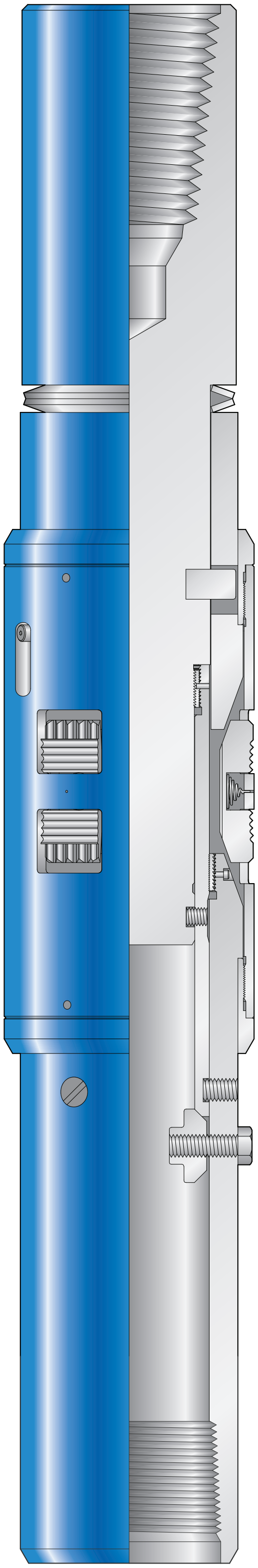
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices for additional detail on retrieving our WindowMaster whipstock without damage using our special taper box tap.

Applications

- For engaging the WindowMaster whipstock so the anchor or packer can be released

Features and Benefits

- Wicker profile for engaging the fish
  - Matches the upper segment of the whipstock profile by special custom design
  - Allows removal without damaging the whipstock face
- Cutlip guide
  - Pulls the whipstock from the wall and guides it into the throat of the box
- Simple design
  - Enhances reliability



TorqueMaster™ bottom-trip retrievable anchor
Product family no. H15054

TorqueMaster Bottom-Trip Retrievable Anchor

Easily and reliably anchor a whipstock in the wellbore

The Baker Hughes TorqueMaster™ bottom-trip retrievable anchor is used to anchor a whipstock in the wellbore. It is an alternative to the packer/anchor assembly, and attaches to the lower end of the whipstock by means of a drillpipe thread. The bottom trip retrievable anchor is for use with the WindowMaster G2™ and the PathMaster™ window milling systems.

To activate the setting sequence, only a bottom restriction is required. This bottom can be in the form of a permanent or retrievable bridge plug, top of cement, liner top, or production packer. With the retrievable bottom-trip anchor, either the universal bottomhole orientation or the measurement-while-drilling orientation method can be used.

The anchor is retrievable with straight overpull on the whipstock. For retrievable applications, a debris management system consisting of an EXCLUDER™ sub, unloader valve, and a shear-type disconnect should be run between the whipstock and the anchor. The debris management system keeps debris from falling around the anchor and possibly fouling the slips during retrieval.

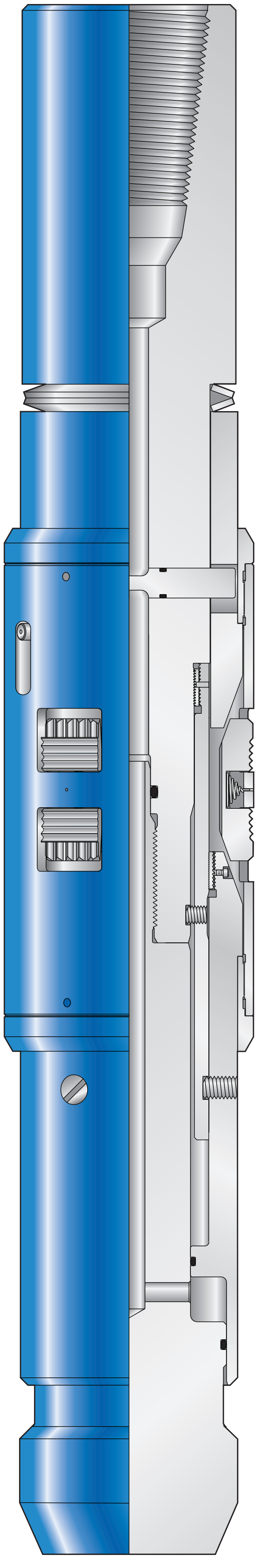
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about using our TorqueMaster bottom-trip retrievable anchor to easily and reliably anchor a whipstock in the wellbore.

Applications

- Anchor a whipstock in place in the wellbore

Features and Benefits

- No welded components
  - Enhances durability
- Does not require circulation to activate
  - Simplifies operation
- Retrievable design
  - Allows for slip retraction, which prevents scarring casing during the retrieval process
- Uses the proven TorqueMaster cam-cone slip system
  - Eliminates risk of rotation



TorqueMaster™ hydraulic-set retrievable anchor
Product family no. H15040

TorqueMaster Hydraulic-Set Retrievable Anchor

Orient whipstock, set anchor, and mill casing exit in one tri

The Baker Hughes TorqueMaster™ hydraulic-set retrievable anchor is used to anchor a whipstock in the wellbore. It is an alternative to the bottom trip anchor assembly, and attaches to the lower end of the whipstock by means of a drillpipe thread. It is used with the hydraulic WindowMaster G2™ or the hydraulic PathMaster™ window milling systems.

When used with the hydraulic whipstock valve, the measurement-while-drilling (MWD) orientation method can be used. The anchor is retrievable with straight overpull on the whipstock. For retrievable applications, a debris management system consisting of an EXCLUDER™ sub, unloader valve, and an emergency disconnect should be run between the whipstock and the anchor. The debris management system keeps debris from falling around the anchor and possibly fouling the slips during retrieval.

When the whipstock reaches the desired setting depth, an MWD tool can be used to establish correct orientation. After the whipstock is properly oriented, flow rate is increased to close the hydraulic whipstock valve. Pressure can now be applied to the hydraulic-set anchor to secure the whipstock in the casing. Pressure of 350–500 psi (24.1–34.5 bar) is required to shear each of the ⅜ in.-16 UNC shear screws. After the screws are sheared, the lower cone ratchets up the shear sleeve. When the lower cone has moved up a sufficient distance, the retrievable TorqueMaster slips begin to move outwards and bite into the casing inside diameter.

Flat ramps on the upper cone provide a cam surface under the slips. Torque forces are then transmitted directly into the slips. As additional torque is applied, the slips become tighter in the casing. To retrieve the anchor, a predetermined overpull is applied to the whipstock to shear the shear screws.

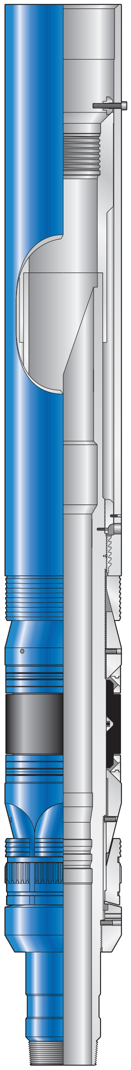
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how our TorqueMaster hydraulic set retrievable anchor can be used to orient whipstock, set anchor, and mill a casing exit in one trip.

Applications

- For anchoring a whipstock in the wellbore

Features and Benefits

- Does not require a restriction in the wellbore to activate
  - Eases operation
- Retrievable design
  - Allows for slip retraction, which prevents scarring during the retrieving process
- TorqueMaster slip system
  - Eliminates risk of rotation
- Redressable with wide setting range
  - Has flexible applications



TorqueMaster™ ML packer
Product family no. H41540

TorqueMaster ML Packer

Retrieve entire packer system in one trip after completion

The TorqueMaster™ ML packer provides permanent orientation for drilling multiple laterals while retaining a primary completion bore below the packer.

The lower cone and torque slips withstand torque loads in excess of 20,000 ft-lb (27.1 kNm). Flat ramps shaped on the lower cone provide a cam surface under the slips. Torque forces slip outward, engaging casing bore. The slip tooth pattern encircles nearly all of the casing inside diameter (ID), locking the packer in place while holding torque and axial loads.

A special 180° orienting clutch is machined directly into the packer body. This design is superior to the lug design on other products. The milling anchor, production anchor, and survey instrument use a clutch for orienting purposes.

The TorqueMaster ML milling and production anchors use proven Baker Hughes bonded seals to seal off the packer bore. After the packer is set and the survey is made, the milling and production anchor can be easily oriented on the surface to a desired direction. Both anchors allow 360° full rotation, adjustable in 3° increments. Latching the anchor into the packer bore isolates the zone and prevents any movement of the whipstock or lateral entry guide.

Standard material grade for the packer and production anchor is 4140–4142 (18-22 Rc) alloy steel. The packer and anchor can be ordered with corrosion-resistant alloy materials and Aflas® elements. The packer can be wireline set or hydraulically set on tubing using standard adapter kits and setting tools.

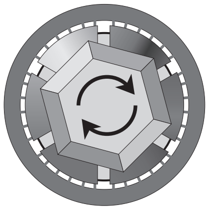
Contact your local Baker Hughes representative or visit www.bakerhughes.com/fishingservices to learn more about using our TorqueMaster ML packer to retrieve an entire packer system in one trip after completion.

Applications

- Multilateral wells where the lower zone requires isolation during drilling of the upper zone

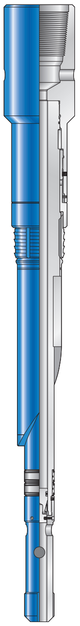
Features and Benefits

- Wireline or hydraulically set
  - Allows multiple applications to fit customer needs
- Optional chrome alloys and Aflas elements
  - Can operate in sour service environments
- Anchors allow 360° full rotation, adjustable in 3° increments
  - Eases orientation on the surface
- Upper sealbore configuration
  - Uses existing bonded seal accessories, saving cost
- One-piece lower-body with 180° clutch-orienting profile
  - Allows easy orientation of the anchor
- Cam-shaped lower cone and slips
  - Withstand torque loads in excess of 20,000 ft-lb torque
- Large bore to completion bore below
  - Provides through-bore access for completing main bore
- 7,500 psi (517.1 bar) pressure rating
  - Can perform reliably in critical differential pressure applications
- No welded components
  - Enhances durability

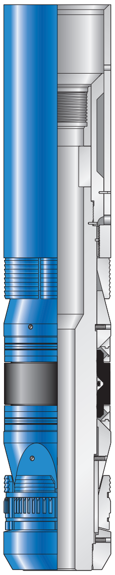


Patented cam-cone system

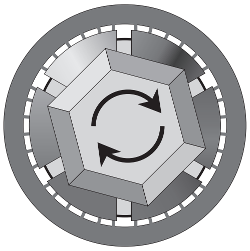
Whipstock Systems, Anchors, and Retrieving Tools



TorqueMaster whipstock anchor
Product family no. H41519



TorqueMaster™ whipstock packer
Product family no. H41518



Patented cam-cone system

TorqueMaster Permanent Packer and Removable Anchor

Isolate and produce lower zone after removing anchor

The Baker Hughes TorqueMaster™ packer permanently orients a TorqueMaster whipstock anchor at a desired location in a cased hole for sidetrack operations.

The lower cone and torque slips can withstand torque loads up to 20,000 ft-lb (27.1 kNm). Flat ramps shaped on the lower cone provide a cam surface under the slips. Torque forces the slips outward, engaging the casing bore. The slip tooth pattern encircles virtually all of the casing inside diameter, locking the packer in place, holding torque and axial loads. The internal guide key of the packer is used to locate the whipstock anchor and survey instruments. The guide key design is superior to other designs because no welding is required to hold the key in place. The key is enclosed and cannot be knocked out of place.

The TorqueMaster whipstock anchor uses proven Baker Hughes bonded seals to seal the packer bore. After the packer is set and a survey is made, the anchor is easily oriented on the surface to the desired direction. The anchor allows 360° full rotation, adjustable in 3°increments. Latching the anchor into the packer bore isolates the zone and prevents any movement of the whipstock.

The Baker Hughes TorqueMaster packer and removable whipstock anchor system is a variation of the Baker Hughes TorqueMaster whipstock permanent packer system, which allows multiple stab-in and stab-out of the whipstock anchor after the packer has been set. This allows the lower zone to be produced after removing the anchor or to space out for another lateral.

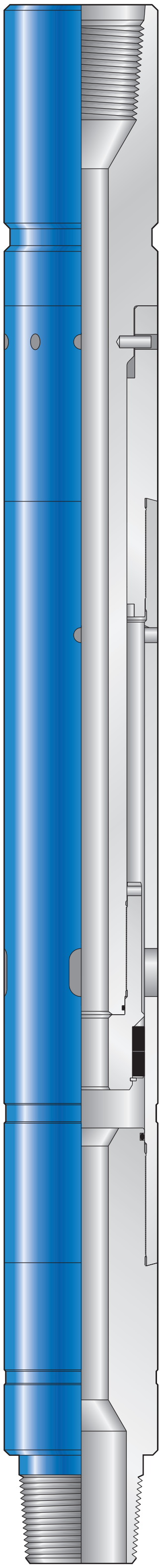
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can isolate and produce the lower zone after removing the anchor using our TorqueMaster permanent packer and removable anchor.

Applications

- Permanently locate a TorqueMaster whipstock anchor in a cased hole for a sidetrack
- Allow the lower zone to be produced after removing the anchor or to space out for another lateral

Features and Benefits

- Only one directional survey is required
  - Saves rig time
- Packer bore is open before the anchor is landed
  - Allows debris to fall through
- Anchor stinger does not extend below bottom of packer
  - Allows easy stab-in even if packer is set on top of cement
- No welded components
  - Enhances durability
- Packer provides isolation of zone below
  - No cement plug is needed
- Piston inside of anchor
  - Allows easy stab-in even with closed fluid volume below packer
- Oriented easily on location
  - Does not break any premium or API thread connections



Unloader valve
Product family no. H14040

Unloader Valve

Prevent damage to well caused by swabbing during whipstock retrieval

The Baker Hughes unloader valve helps prevent the swabbing of the well during whipstock retrieval by providing an exit path for the fluid that has entered the excluder port. The unloader valve transmits torque through the hexagonal profile of the inner mandrel, and is placed below the excluder sub in the retrievable whipstock assembly.

When pickup force above a predetermined level is applied to the whipstock assembly, the shear screws shear and the unloader valve's outer mandrel shifts. This upward stroke acts as an indicator during the whipstock retrieval process and opens fluid flow ports that allow well fluid to pass through the excluder mandrel, preventing well swabbing.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn more about how our unloader valve can be used to prevent damage to your well caused by swabbing during whipstock retrieval.

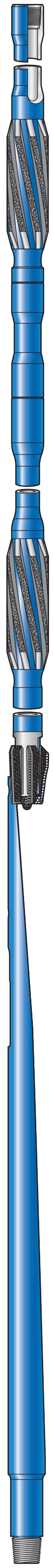
Applications

- To prevent swabbing of the well

Features and Benefits

- Rotationally locked
  - Withstands high torsion loads
- Shear screws
  - Shear at predetermined pickup force to activate unloader valve
- Fluid flow ports
  - Allow well fluid to flow through excluder mandrel and prevent swabbing

Whipstock Systems, Anchors, and Retrieving Tools



WindowMaster G2™ whipstock system
Product family no. H15015

WindowMaster G2 Whipstock System

Combine powerful cutting technology with minimum downhole trips and maximum retrievability

The Baker Hughes WindowMaster G2™ whipstock system requires only one trip with drillpipe to complete a window and drill a pilot hole. It features a full-drift outside diameter window mill that requires less rathole to be drilled, which saves valuable rig time. This state-of-the art system saves substantial rig time by eliminating at least two round trips with drillpipe that are required by conventional window-cutting systems.

The WindowMaster G2 system can be run in hole, oriented to the new hole direction, anchored in place, and completely mill a window, all in one trip. Orientation can be performed with measurement-while-drilling, universal bottomhole orientation, or gyro into packer profile. In addition, the milling bottomhole assembly eliminates the risks of mill connection and body failure during milling.

The system is retrievable when run with the TorqueMaster™ bottom trip anchor or TorqueMaster packer in conjunction with a retrievable anchor. Two retrieving-tool options ensure retrievability in a wide variety of hole conditions.

The WindowMaster G2 window mill incorporates Baker Hughes METAL MUNCHER™ cutting structures. METAL MUNCHER technology enables the operator to mill the window quickly and efficiently without sacrificing window quality, and apply minimum weight and torque to the workstring. The resulting cuttings are small and easily circulated out of hole.

The WindowMaster G2 whipstock system is compatible with the Baker Hughes PathMAKER™ formation mill, which provides exceptional milling and drilling performance in hard formations. When used together, the WindowMaster G2 whipstock system and PathMAKER formation mill can provide several hundred feet of rathole if required to fit large rotary steerable drilling assemblies out of the casing.

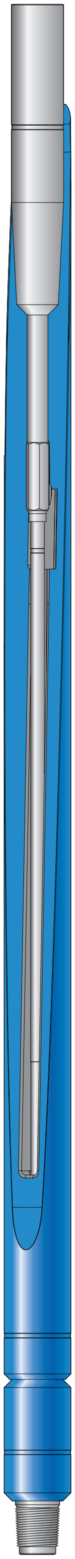
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices for more information on using our WindowMaster G2 whipstock system to complete a window and drill a pilot mill in one trip.

Applications

- Milling windows
- For drilling hard formation, pilot hole, drift window, and rathole
- Reaming

Features and Benefits

- Full-gauge window mill
  - Provides a drift window and rathole
- Retrievable for multiple-zone applications
  - Saves on equipment costs
- METAL MUNCHER cutting technology
  - Can mill and ream simultaneously
- TorqueMaster packer technology
  - Works in high-temperature/high-pressure applications



Openhole whipstock system
Product family no. H15162
H15164 (running tool)

Openhole Whipstock System

Complete a one-trip whipstock installation for openhole sidetracking

The Baker Hughes openhole whipstock system (OHWS) was developed using proven PathMaster™ technology to provide a versatile solution that allows openhole sidetracking operations using a solid kick-off point.

The whipstock face can be oriented using either measurement-while-drilling (MWD) methods or universal bottomhole orientation (UHBO), as with normal cased hole applications. The openhole whipstock system has a full bore inside diameter (ID) and stinger tube to allow full circulation through the bottomhole assembly (BHA) during run-in and anchoring operations. This allows for unrestricted cementing options and provides compatibility with several different anchoring options such as the Baker Hughes BigFoot™ openhole whipstock anchor and retrievable inflatable whipstock anchor.

After being firmly anchored, the openhole whipstock running tool is sheared from the assembly and pulled out of hole. The milling BHA is run in and normal sidetracking operations can begin.

Baker Hughes can complete a one-trip openhole whipstock installation using the OHWS for cemented and non-cemented applications in less than 24 hours on average. The OHWS can use any Baker Hughes openhole anchoring methods, providing a quick and effective openhole sidetracking solution.

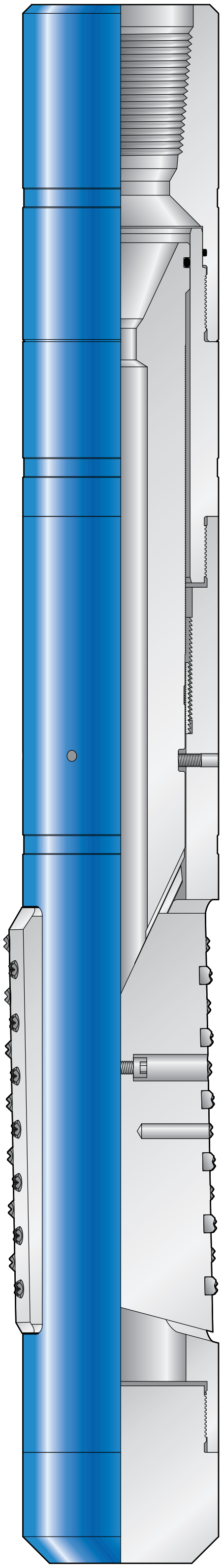
Applications

- Allows for openhole sidetrack operations using a solid kick-off point

Features and Benefits

- Reduced length BHA
  - Allows system to pass through high doglegs and short-radius build sections
- Short, contoured, hardened steel whipstock face
  - Provides positive deflection of the drilling BHA in hard formations
  - Kicks the drilling BHA off in the desired orientation, unlike conventional cement plugs
- Full through ID and stinger tube
  - Allows flow path through the whipstock for cemented applications
- Rugged design
  - Allows for high torque capacity through the assembly during sidetracking operations

Whipstock Systems, Anchors, and Retrieving Tools



BigFoot™ openhole whipstock system
Product family no. H16000

BigFoot Openhole Whipstock Anchor

Maintain anchor integrity throughout sidetracking operations without slippage or damage to the formation

The Baker Hughes BigFoot™ openhole whipstock anchor is a permanent anchor that is used to set whipstocks in openhole applications to perform sidetracking operations. The anchor secures the whipstock in a predetermined location by contacting the wellbore formation, and maintains its anchor integrity throughout the sidetracking operation.

The BigFoot anchor is aligned with the whipstock face, which places the whipstock in a biased position, maximizing the contact with the wellbore and promoting positive displacement for subsequent drilling bottomhole assemblies.

The BigFoot anchor is run in conjunction with the Baker Hughes openhole whipstock and openhole running tool, providing a complete bottomhole system and a robust solution for openhole wellbore sidetracking applications. The anchor is constructed using a proven locking system and slip design to ensure the anchor retains the setting forces and slip engagement against the formation wall throughout the sidetracking operations without slippage or damage to formation.

Contact your Baker Hughes representative or visit www.bakerhughes.com/fishingservices to learn more about how our BigFoot openhole whipstock system can maintain anchor integrity throughout sidetracking operations without slippage or damage to the formation.

Applications

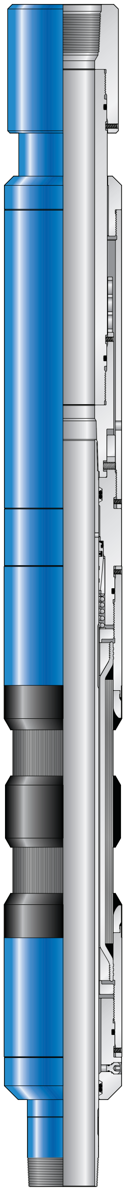
- Hydraulically set a permanent anchor for openhole whipstock applications

Features and Benefits

- Inclined Foot
  - Biases the whipstock toward the formation, reducing standoff and facilitating movement down the face
- Dovetail on slip
  - Increases stability while setting
- Large piston area
  - Allows large setting force with standard setting pressures
- Spacer rings
  - Eases alignment of anchor to whipstock face
- Carbide slip inserts
  - Provide maximum engaging strength with the formation

Retrievable Inflatable Whipstock Anchor

Cover multiple casing weight applications with one inflatable element



Retrievable inflatable whipstock anchor
Product Family H30039

The Baker Hughes retrievable inflatable whipstock anchor allows a whipstock to be set in cased hole or open hole and covers a wide range of casing weight conditions with a single inflatable element. The wellbore seal and anchor are provided by an inflatable element that is set by increasing the drillpipe pressure at surface. This anchor provides a retrievable inflatable alternative to hydraulically activated anchoring systems that are available for the hydraulic WindowMaster™ one-trip window cutting system.

In operation, after the window cutting is completed, a second trip allows retrieval of both the whipstock and the anchor as a single unit. A unique benefit is that this system remains a true one-trip system for both setting of the whipstock anchor and cutting of the sidetrack window. Retrieval is carried out using a fixed lug retrieving tool or other typical whipstock retrieving tools. The anchor includes a release mechanism activated by tension. Therefore, the straight pull required to retrieve the whipstock also actuates the release mechanism in the anchor. When tension is applied, the body of the anchor shifts to the deflate position. The pressure in the inflatable element is released and consequently the seal and anchor are removed. The anchor and whipstock can then be retrieved.

For openhole applications the retrievable inflatable whipstock anchor is run in hole in conjunction with Baker Hughes openhole whipstock system (OHWS). The assembly is lowered to depth and oriented, and then hydraulic pressure is applied to the drill string to inflate the anchor.

After the anchor is set, the run-in assembly of the OHWS can be removed from the hole and the sidetrack operation can begin. The Baker Hughes retrievable inflatable whipstock anchor can be removed after the sidetrack is complete for multilateral applications. Furthermore, it includes the capability to be cemented through tailpipe below, cemented from the anchor up, or both.

Contact your Baker Hughes representative or visit www.bakerhughes.com/fishingservices to learn more about how our retrievable inflatable whipstock anchoring system can cover multiple casing weight applications with one inflatable element.

Applications

- Inflatable anchoring solution for Baker Hughes cased hole/openhole whipstock systems

Features and Benefits

- Multitude of applications
  - Can be used in cased hole and open hole
  - Can be cemented through
  - Has option of delayed opening valve
- Straight pull deflates the element and releases the anchor
  - Enables use in openhole completions
- Double anchor with large holding area
  - Can hold the whipstock in place without the need to pump cement
  - Has large holding area
  - Provides strength and resistance to torque
- Can be set in a wide range of IDs
  - Can be used in a wide range of casing weights
  - Can be used in openhole applciations

Notes

Pilot Section Milling

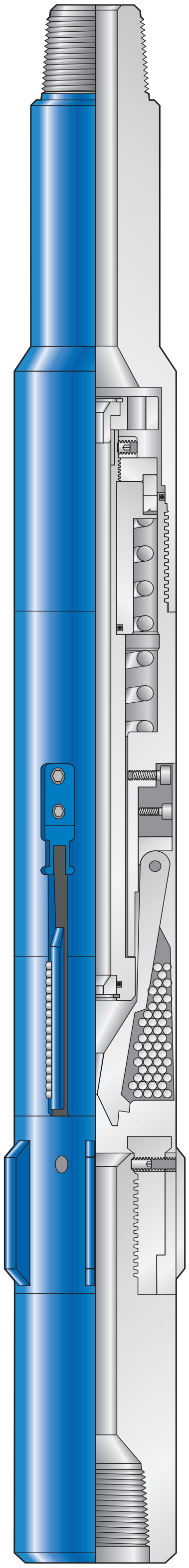
D Section Mill

METAL MUNCHER Pilot Mill

LOCKOMATIC Section Mill Dressed with AMT Cutters

METAL MUNCHER Turbo Pilot Mill

Pilot Section Milling



D™ section mill
Product family no. H15072

D Section Mill

Mill in sidetracks and debris-ridden wellbores with maximum efficiency

The Baker Hughes D™ section mill is an inside cutter and a section mill for sidetracking operations, as well as for milling perforated casing in production zones, loose joints of surface pipe, and old casing for cementing new smaller casing to the formation.

The D section mill should be run with a minimum of 10,000 lb (4536 kg) of string weight in the bottomhole assembly. A bit or mill is run to help the tool enter the hole and stir cuttings during milling. The cut is started slowly, approximately 2 to 5 ft (0.6 to 1.5 m) above a coupling, and then brought to a speed of 80+ rpm for the cut-out. The pump is started and the number of strokes is increased to give a minimum pressure drop of 400 psi (27.6 bar) across the mandrel nozzle. During cut-out, approximately 1 in. (25.4 mm) is slacked off in 1/16-in. (1.6-mm) increments over a period of 5 to 10 minutes. When the pump gauge shows a definite pressure drop of 200 psi (13.8 bar), indicating that the casing has been cut through, pressure is increased until the annular velocity is sufficient to bring cuttings out of the hole. Rpm and weight on mill can be adjusted to obtain optimum mill performance.

After milling 3 to 5 ft (0.9 to 1.5 m), rotation continues and the pump is stopped while picking up off the casing. Pressure is allowed to equalize and rotation is stopped while picking up into the casing above the cut point. Pressure is then resumed and slacked off into the window. The resulting pressure drop verifies cut-out and removes any shavings that may have entered the tool while the window cut-out was made. Milling operations can then be continued.

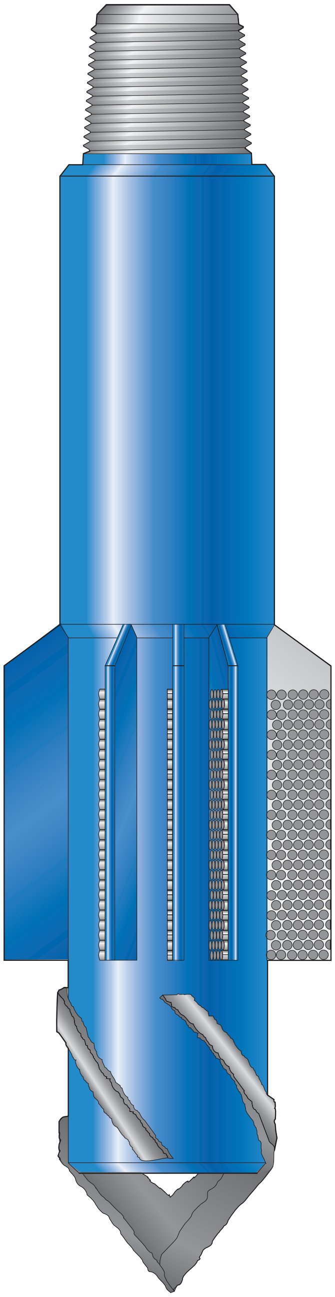
Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes D section mill can help you mill casing efficiently.

Application

- Sidetracking operations
- Milling:
  - Perforated casing in production zones
  - Loose joints of surface pipe
  - Old casing for cementing new smaller casing to the formation

Features and Benefits

- Hydraulic operation
  - Provides fast, efficient downhole milling
- Unique knife design
  - Reduces long stringers
  - Removes casing in short chips for easy cleanout
- Six knives used for initial cut-out
  - Reduce cut-out time
  - Minimize risk of bent or broken knives
- METAL MUNCHER dressing on knives
  - Improves cutting performance



METAL MUNCHER™ pilot mill
Product family no. H15121

METAL MUNCHER Pilot Mill

Mill faster with high ROP and continually renewed cutting surfaces

The Baker Hughes METAL MUNCHER™ high-performance pilot mill is used for milling washover pipe, casing, and liners. The blade design of the METAL MUNCHER mill continuously indexes a new cutting surface during milling for constant ultra sharpness. The insert design produces small, uniform, and easy-to-handle cuttings for easy wellbore cleanout.

The METAL MUNCHER pilot mill should be run with a shock sub and sufficient drill collars to provide a wide range of milling weights. Both weight on mill and revolutions per minute (rpm) are determined by penetration rate, torque, and cuttings removal. Pilot milling done with METAL MUNCHER inserts should be treated as a machining process instead of a milling process. After optimum weight and rpm are established, they should be adhered to.

The METAL MUNCHER cutting structure provides a high rate of penetration (ROP), which in turn requires a mud system capable of suspending the cuttings and carrying them to the surface. We recommend additional surface equipment to handle cuttings.

METAL MUNCHER pilot mills are available to cut all standard sizes of casing and can be manufactured for any size. They also can be manufactured with a connection down for milling applications that are too close to surface to run sufficient drill collar weight above the mill. This allows weight to be hung from below the mill to efficiently mill casing at shallow depths.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how you can mill faster with high ROP and continually renewed cutting surfaces with the Baker Hughes METAL MUNCHER pilot mill.

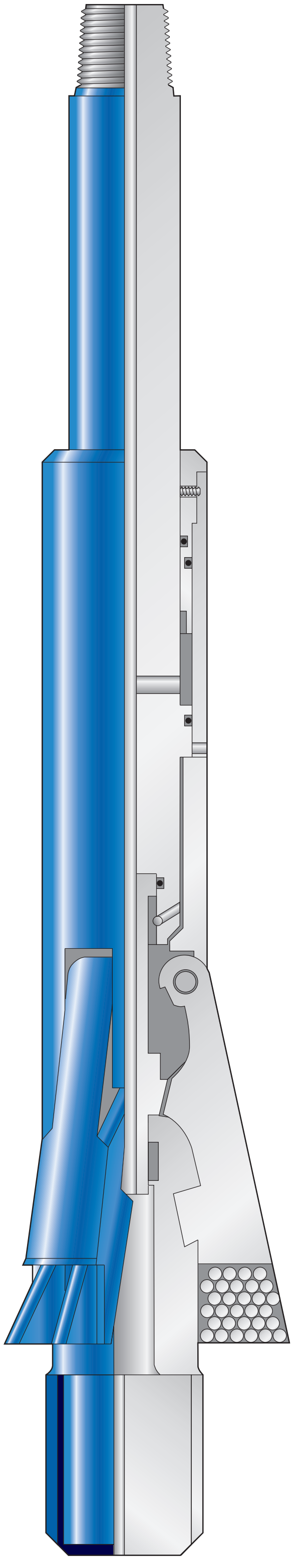
Application

- Mill washover pipe, casing, and liners

Features and Benefits

- Increased ROP
  - Speeds up milling
- Insert design
  - Produces smaller cuttings
  - Eases cleaning of wellbore
- Hardened surfaces on areas of high wear
  - Extend mill life

Pilot Section Milling



LOCKOMATIC section mill dressed with AMT cutters
Product family no. H15079–H15089

LOCKOMATIC Section Mill Dressed with AMT Cutters

Optimize operations with fast run-in and reliable performance

The Baker Hughes LOCKOMATIC™ section mill dressed with advanced milling technology (AMT) cutters features a positive, direct lock, and unlock mechanism for expanding drilling and milling tools. The LOCKOMATIC mill is as reliable as the drillstring itself because the lock is an extension of the drillstring. The mill is dressed with Baker Hughes top-of-the-line AMT cutters for superior milling performance. The LOCKOMATIC mill is unmatched for hole opening, underreaming, and casing milling.

Fast trip-in rates are possible because the cutter arms are locked closed. The tool has a patented design feature that damps off downhole hydrostatic pressure from the pressure ports, preventing hang-ups while running in.

Operation of the tool is smooth and efficient. Circulation pressure moves the body and cutters upward by increasing the annular volume between the kelly and upper body. Because the patented LOCKOMATIC mandrel lock remains in place as part of the drillstring, the cutter arms come out over the mandrel lugs, forcing the cutters to expand. On box-down models, when the bit also cuts, applied drilling weight expands the cutters and helps maintain their position.

On reaching gauge, the cutters lock in place and stay locked as long as pressure or drilling weight is applied. The tool will not take true drilling weight until the cutter arms are locked out to full-gauge cutting position.

To enable retrieval of the LOCKOMATIC tool, pressure must be released and the tool picked up. This retracts the mandrel lock from under the cutters. If chips and cuttings penetrate the collapsing mechanism, the pull of the draw will force obstructions out of the way and closes the cutter arms. Springs and hydraulics are not involved. The LOCKOMATIC mill retrieves as easily as the drillstring. Tool sizes range from 3¾-in. (95.2-mm) closed gauge to 48-in. (1219.2-mm) open gauge.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to learn how you can expand drilling and milling tools with our LOCKOMATIC section mill dressed with AMT cutters.

Application

- Hole opening
- Underreaming
- Casing cutting

Features and Benefits

- Fast run-in
  - Saves rig time
- Positive expansion
  - Pressure drop and weight change provide indication
- Positive locking and unlocking
  - Prevents underguage milling
  - Ensures retrieval
  - Prevents tool hang-up

Pilot Section Milling

LOCKOMATIC Underreamer

Specification Legend

A	Short body
B	Long body
G	Body with box down, mandrel not packed off
K, L	LOCKOMATIC actuating system
M	Section mill cutter for all models
S	Spiral pilot body
W	Body with box down, mandrel packed off in box
X	Extra long body for overreaching expansions

Example

10 K W A

A — Short body

W — Body with box down

K — LOCKOMATIC actuating system

10 — Size 10

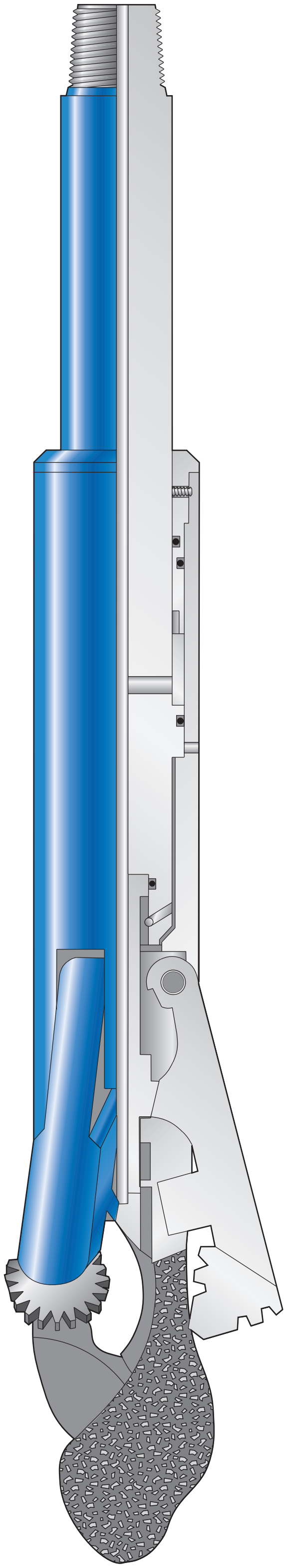
Specification Guide

Product Family No.	Size	Model	API Reg (Pin Up)	API Reg (Box Down)	Tool OD	
			in.	in.	in.	mm
H15079	2	KSA, KSB, KSX, KMB	2.375	NONE	3.688	94.0
		KMGB, KMWB		2.375		
H15080	3	KSA, KSB, KMB	2.375	NONE	4.250	108.0
H15081	4	KSA, KSB	2.375	NONE	4.750	121.0
		KGA, KMWB		2.375		
H15082	5	KSA, KSB, KMB	3.500	NONE	5.563	141.3
		KGA, KMWX, KWA, KWB		3.500		
H15083	6	KSA, KSB, KSX, KMB	3.500	NONE	6.000	152.4
		KGA, KGB, KGX, KMWB, KWB		3.500		
H15084	7	KSA, KSB, KMB	4.500	NONE	7.500	191.0
		KGA, KGB, KMGB, KMWB, KWB		4.500		
H15085	8	KSB, KMB	4.500	NONE	8.500	216.0
		KGB		4.500		
H15086	9	KSA, KSB, KMB	5.500	NONE	9.500	241.3
		KWA		6.625		
H15087	10	KSA, KSB, KMB, LSA	6.625	NONE	12.000	305.0
		KWA, KWX		6.625		
		LWA		7.625		
H15088	11	KWA, KWB	6.625 7.625	NONE	14.500	368.3
		LWA, LWB	6.625 7.625	6.625 7.625		
H15089	12	KWB	7.625	7.625	18.000	457.2

AMT cutter arm

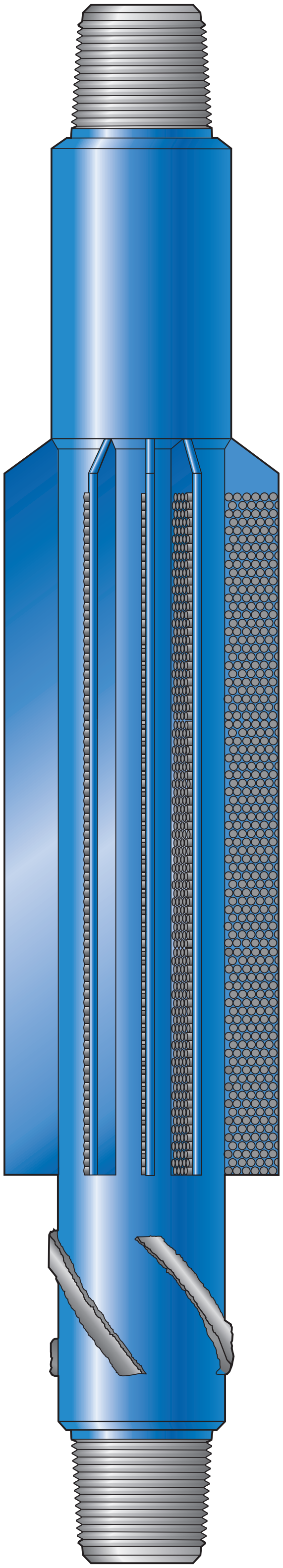
PDC cutter arm

Roller cone cutter arm



LOCKOMATIC Underreamer
Product family nos. H15079-H1089

Pilot Section Milling



METAL MUNCHER™ turbo pilot mill
Product family no. H15121

METAL MUNCHER Turbo Pilot Mill

Mill long sections of casing with extended blades on mill

The Baker Hughes METAL MUNCHER™ turbo pilot mill is a high-performance mill used for milling washover pipe, casing, and liners. The turbo pilot design has 18-in. (457-mm) blades for slot recovery and milling long sections of casing. The blades continuously index new cutting surfaces during milling. The insert design produces small, uniform, and easy-to-handle cuttings.

It should be run with a shock sub and sufficient drill collars to provide a wide range of milling weights. Both weight on mill and revolutions per minute (rpm) are determined by penetration rate, torque, and cuttings removal. Pilot milling with METAL MUNCHER inserts should be treated as a machining process rather than a milling process. After the optimum weight and rpm are established, they should be adhered to.

The METAL MUNCHER cutting structure provides a high rate of penetration (ROP). This requires a mud system capable of suspending the cuttings and carrying them to the surface. Additional surface equipment to handle cuttings should also be considered.

METAL MUNCHER pilot mills are available to cut all standard sizes of casing and can be manufactured for any size. They also can be manufactured with a connection down for milling applications that are too close to surface to run sufficient drill collar weight above the mill. This allows weight to be hung from below the mill to efficiently mill casing at shallow depths.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/fishingservices to find out how the Baker Hughes METAL MUNCHER turbo pilot mill can help you more efficiently mill washover pipe, casing, and liners.

Application

- Mill washover pipe, casing, and liners

Features and Benefits

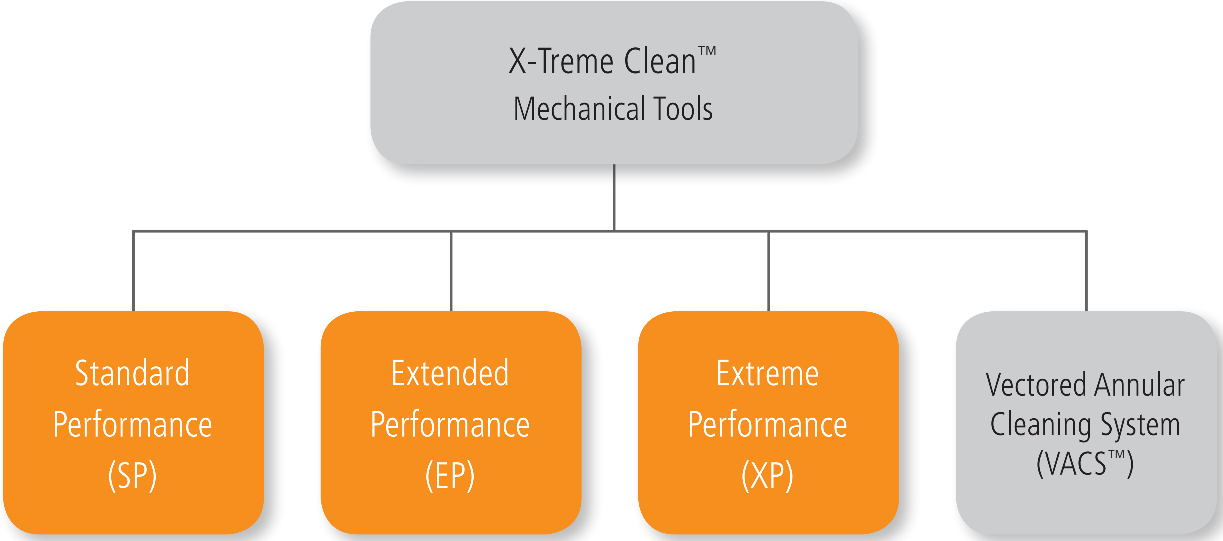
- Extended 18-in. blades
  - Allows milling of long sections of casing
  - Enables slot recovery
- Increased ROP
  - Speeds milling time
- Insert design
  - Produces smaller, more uniform cuttings
  - Eases cleaning of wellbore
- Hardened surfaces on areas of high wear
  - Increase durability and tool life

X-Treme Clean WBCU and Displacement Tools Guide

During completion operations, debris and residue can accumulate in the well and interfere with the proper installation and performance of completion and workover systems, and even damage the formation. Our X-Treme Clean™ line of wellbore cleanup mechanical tools includes reliable, modular systems that remove debris before the well is completed to ensure successful, trouble-free operations.

The X-Treme Clean line of mechanical tools includes different tiers of products and services to match your application.
The X-Treme Clean (extreme performance) XP wellbore cleanup and displacement system for deep, deviated, and extended reach wells includes heavy-duty scrapers, brushes, magnets, junk baskets, and filters. Each component can be used individually or together in any combination to match your job requirements. The X-Treme Clean XP system is available in a full range of sizes to clean all casing sizes typically used in deepwater wells.

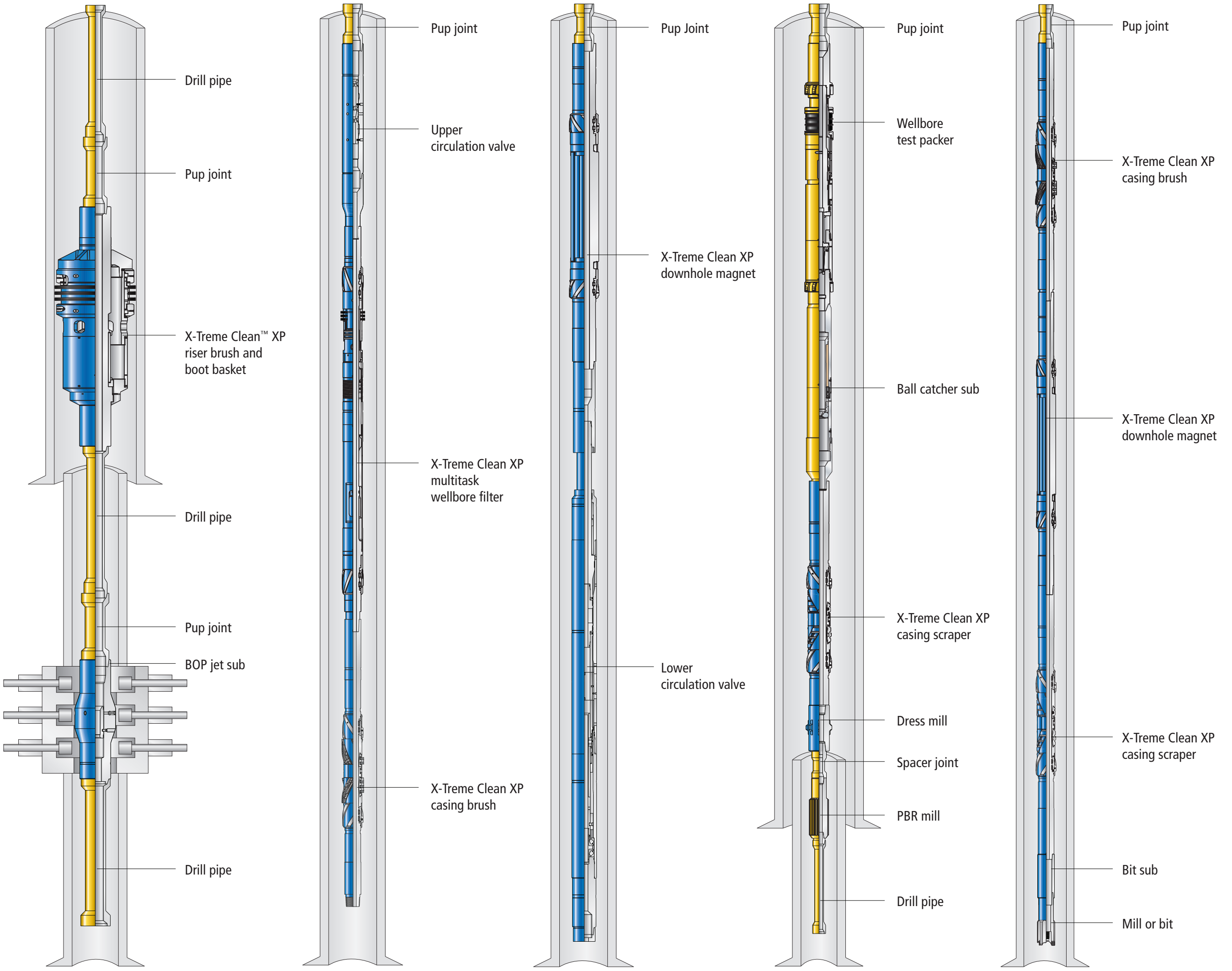
The X-Treme Clean (extended performance) EP system is also a modular system with wellbore cleanup components optimized for land, shelf, and shallow water applications. The X-Treme Clean EP system has successfully completed thousands of wellbore cleanup operations worldwide.


X-Treme Clean™ Mechanical Tools
Standard Performance (SP)
Extended Performance (EP)
Extreme Performance (XP)
Vectored Annular Cleaning System (VACS™)

Please refer to Section 16 for more information about our VACS portfolio

WBCU Introduction

The X-Treme Clean (standard performance) SP system includes simple and robust wellbore cleanup tools with a long history of reliable performance, making this part of the WBCU portfolio ideal for land applications or other low cost environments. This basic set of tools is primarily composed of scrapers, junk baskets, and circulation tools.


Drill pipe
Pup joint
X-Treme Clean™ XP riser brush and boot basket
Drill pipe
Pup joint
BOP jet sub
Drill pipe
Pup joint
Upper circulation valve
X-Treme Clean XP multitask wellbore filter
X-Treme Clean XP casing brush
Pup Joint
X-Treme Clean XP downhole magnet
Lower circulation valve
Pup joint
Wellbore test packer
Ball catcher sub
X-Treme Clean XP casing scraper
Dress mill
Spacer joint
PBR mill
Drill pipe
Pup joint
X-Treme Clean XP casing brush
X-Treme Clean XP downhole magnet
X-Treme Clean XP casing scraper
Bit sub
Mill or bit

X-Treme Clean™ XP wellbore cleanup and displacement system for deep water and ultradeepwater

Casing Cleaning Tools

XP Casing Scraper

EP ULTRA-CLEAN Casing Scraper

EP WELL-CLEAN Casing Scraper

SP 360° Clean Bore Casing Scraper

SP D Roto-Vert Tubing Scraper

EP Expandable Mill

XP Casing Brush

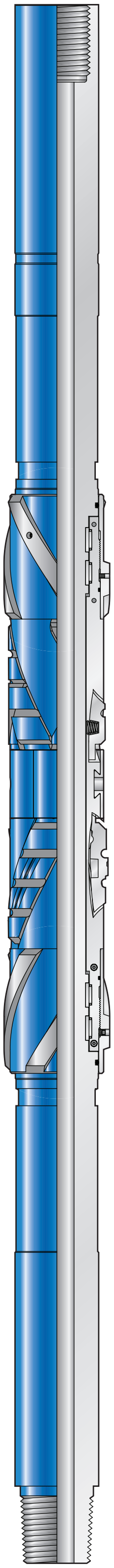
EP ULTRA-CLEAN Casing Brush

EP WELL-CLEAN Casing Brush

EP Disposable Casing Brush

BAKER HUGHES
George

Casing Cleaning Tools



X-Treme Clean™ XP casing scraper
Product family no. H16110

XP Casing Scraper

Achieve effective casing cleaning with high-rotation, high-strength, and larger-flow-area tools

The Baker Hughes X-Treme Clean™ XP casing scraper is a durable tool for deepwater, deep, and deviated well applications. It is used to remove mud or cement sheath, perforation burs, rust mill scale, paraffin, and similar substances from interior walls of casing. The tool can be run by itself or as an integral part of a complete wellbore cleaning system with circulation tools, brushes, magnets, filters, and bits.

The casing scraper features one-piece mandrel design without any internal connection. The tensile and torque ratings of the tool are higher than those of the tool joint. This allows the tool to be used in deep wells or deviated wells in which higher tensile and torque ratings are required.

One feature of the tool is its high allowable rotation speed. Allowing drillpipe to rotate up to 150 rpm significantly increases the cleaning efficiency and also allows the tool to be used in the drilling or milling applications in which high rotation speed is required.

The tool also provides large inside diameter and annulus flow areas. It allows for more effective circulation and displacement operations.

The new helical blade design uses both sides and ends of the blade blocks providing more than doubled scraping area than the conventional scraper. The non-rotating blades and stabilizers prevent any excessive wear or damage to the casing when pipe rotation occurs.

11TH ANNUAL WORLD OIL® AWARDS
2012 WINNER
BEST WELL INTERVENTION

EP ULTRA-CLEAN Casing Scraper

Clean wellbore with minimum wear to casing ID

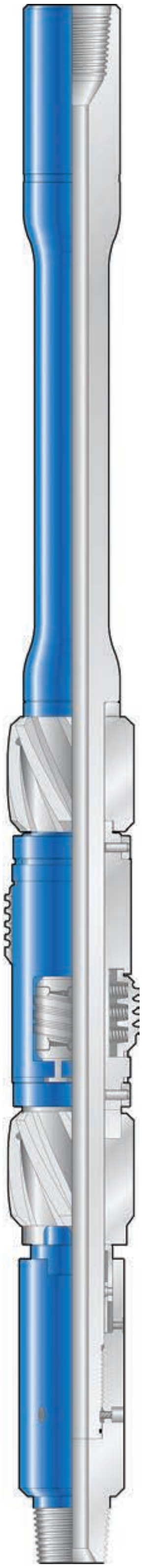
The Baker Hughes X-Treme Clean™ EP ULTRA-CLEAN™ nonrotating casing scraper is used to remove mud or cement sheath, rust, mill scale, paraffin, and similar substances from the casing inner diameter (ID). This is especially important in precompletion stages where tight tolerance equipment will be run. These scrapers are also a very effective component of the bottomhole assembly (BHA) when making gauge runs.

The tool's standard operating mode is in the nonrotating position. The 360° coverage blades and stabilizers remain stationary while the drillpipe can be rotated for long periods during circulation to clean the wellbore. This feature allows maximum casing cleaning without wearing the casing ID. In the case that the scraper becomes stuck, straight overpull will shear a ring and allow the safety clutch to engage, putting the scraper in the rotating mode, allowing it to be worked free using torque, overpull, circulation, and jarring.

The tool is designed with ample circulation area to allow for high-rate circulation and bypass of debris. It has a rugged design and contains no external bolts that could work loose under extreme conditions. For this reason, the X-Treme Clean EP ULTRA-CLEAN casing scraper is recommended for use when drilling cement on the cleanout run.

The tools can be conveniently converted with dress-off mill to allow for cleaning the liner top and casing ID in one trip.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP ULTRA-CLEAN scraper helps you effectively clean your casing ID.



X-Treme Clean™ EP ULTRA-CLEAN™ casing scraper
Product family no. H16107

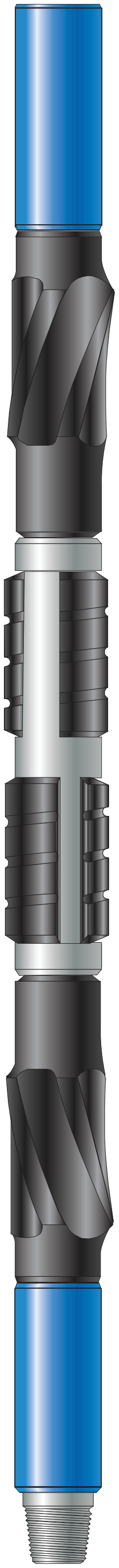
Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement

Features and Benefits

- Nonrotating stabilizers and blades
    - Eliminates risk of damage to casing when rotating or drilling
- Safety clutch design
    - Allows tool to work free if stuck in hole
- No external fasteners
    - Avoids leaving parts downhole
- Blade with 360° coverage
    - Provides high cleaning effectiveness
- Hard metal applied to blade edge
    - Provides endurance and maximum service
- Dress-off mill option
    - Allows for cleaning casing ID and liner top in one trip

Casing Cleaning Tools



X-Treme Clean™ WELL-CLEAN casing scraper
Product family no. H16117

EP WELL-CLEAN Casing Scraper

Clean casing ID during displacement and reduce risk of casing damage

The Baker Hughes X-Treme Clean™ WELL-CLEAN casing scraper is used to remove mud or cement sheath, rust, mill scale, paraffin, and similar substances from the casing inner diameter (ID). This is especially important in precompletion stages where tight tolerance equipment will be run. These scrapers are also a very effective component of the bottomhole assembly (BHA) during gauge runs.

The tool features an ample circulation area to allow for high-rate circulation and bypass of debris. It has a rugged design and contains no external bolts that could work loose under extreme conditions. The 360° coverage blades remain stationary to eliminate casing damage, while the drillpipe can be rotated for long periods during circulation to properly clean the wellbore. For these reasons, the X-Treme Clean WELL-CLEAN casing scraper is recommended for use when drilling cement on the cleanout run.

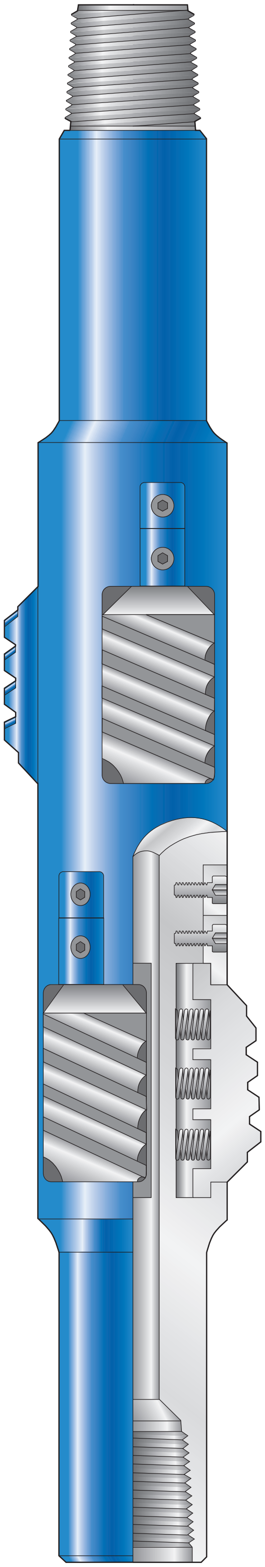
Contact your Baker Hughes representative today to find out how our X-Treme Clean WELL-CLEAN casing scraper helps you effectively clean casing ID during displacement and reduce risk of casing damage.

Applications

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement

Features and Benefits

- Heavy-duty steel construction
  - Withstands rotation and reciprocation for long periods of time
- High-torque connections
  - Minimize crossovers
- Contains no external screws, bolts, or blocks
  - Eliminates risk of parts working loose under extreme operating conditions
- Spring-mounted blades
  - Provides optimal engagement with casing
- Unique staggered-blade configuration
  - Ensures 360° contact for optimal cleaning
- Nonrotating blades
  - Eliminate risk or damage to casing during rotation



X-Treme Clean™ SP 360°
clean bore casing scraper
Product family no. H16105

SP 360° Clean Bore Casing Scraper

Clean casing interiors efficiently and reliably

The simple and robust Baker Hughes X-Treme Clean™ SP 360° clean bore casing scraper cleans casing through reciprocation or rotation. It removes cement, mud, rust, scale, paraffin, and other restrictions from the inside wall of casing, significantly mitigating the completion and production risks and costs.

Operators benefit from the solid piece of heat-treated alloy steel that makes up the casing scraper mandrel. The hard-faced blades provide endurance and maximum service life. The blade arrangement provides full 360° contact with the casing inner diameter for better cleaning.

The 360° clean bore casing scraper is available in 4$^1/_2$-in. to 13$^3/_8$-in casing sizes.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the X-Treme Clean SP 360° clean bore casing scraper can help you effectively clean casing interiors.

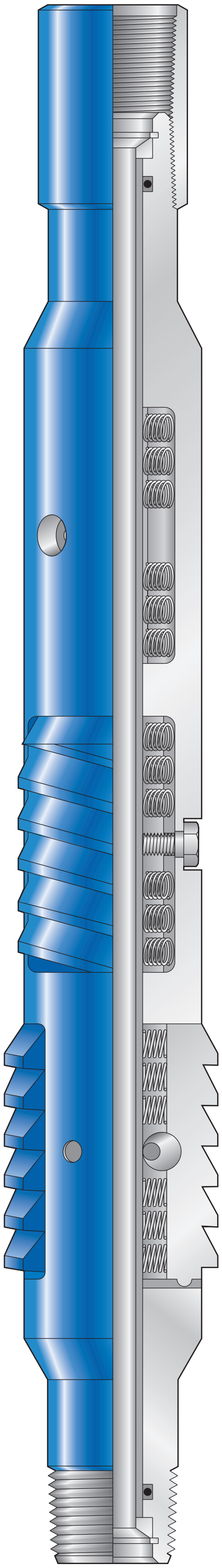
Applications

- Conventional oil and gas
- Unconventional hydrocarbons
- Wellbore cleanup

Features and Benefits

- Hard-faced blades
  - Provides endurance and maximum service
- Cleans through rotation or reciprocation
  - Provides better cleaning efficiency
- Simple design
  - Allows easy operation
- High-strength one-piece steel body
  - Increases reliability

Casing Cleaning Tools



X-Treme Clean™ SP D roto-vert tubing scraper
Product family no. H62061

SP D Roto-Vert Tubing Scraper

Clean tubing ID with cost-effective solution

The Baker Hughes X-Treme Clean™ SP D roto-vert tubing scraper provides a safe, efficient, and economical method of removing any obstructions such as mud, rust, scale, paraffin, and other types of coating from the inside diameter (ID) wall of tubing.

The tubing scraper, which can be deployed on tubing or wireline, is normally run with a bit or mill dressed to drift. The scraper has 360° coverage and does not require rotation to clean the inside of the tubing.

The SP D roto-vert tubing scraper is available for 2⁷/₈-in. to 4-in. tubing sizes.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean SP D roto-vert tubing scraper can help you clean your wells more efficiently.

Application

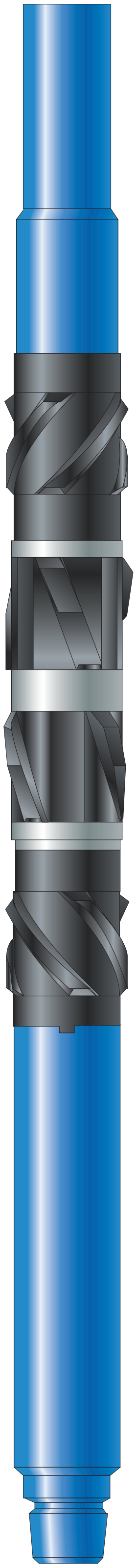
- Conventional oil and gas
- Unconventional hydrocarbons
- Tubing ID cleaning
- Wellbore cleanup

Features and Benefits

- Simple and robust design
  - Allows easy and reliable operation
- 360° coverage
  - Provides cost-effective casing cleaning solution

EP Expandable Mill

Clean casing ID after perforation and minimize casing wear with deactivated blades



Expandable mill
Product family no. H15139

The Baker Hughes expandable mill removes perforating burrs and other debris from the inside diameter (ID) of the casing during post-perforating operations. This operation is essential to ensure successful installation of completion equipment. This mill deburrs while minimizing casing wear during prolonged rotation by retracting the mill's blades.

Tungsten carbide coated blades are arranged to achieve 360° contact with the ID without requiring pipe rotation. Ball-drop deactivation retracts the blades away from the casing wall as needed when the cleaning operation is complete. Full flow is maintained through the tool throughout the operation.

The expandable mill is available in 7.00-in. and 9.63-in. casing sizes.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes expandable mill helps you clean debris while minimizing casing wear.

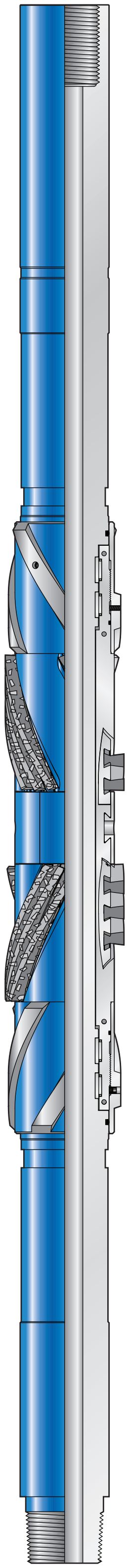
Applications

- Post-perforation, before completion hardware installation
- Conventional oil and gas
- Unconventional hydrocarbons
- Wellbore cleanup

Features and Benefits

- Ball-drop-deactivated blades
  - Minimizes casing wear during prolonged rotation
- Full flow to bit after deactivation
  - Maximizes circulation
- Heavy-duty steel construction with no external fasteners
  - Eliminates risk of leaving small parts downhole
- Spring-supported mill blade
  - Maintains consistent contact with casing ID
- Unique staggered mill blade configuration with 360° coverage
  - Effectively cleans casing ID
- Self-centralizing tool
  - Ensures proper deburring of perforations
- Designed to be rotated and reciprocated
  - Can be run in conjunction with Baker Hughes wellbore cleanup tools

Casing Cleaning Tools



X-Treme Clean™ XP casing brush
Product family no. H16109

XP Casing Brush

Ensure effective casing cleaning with high-performance tools

The Baker Hughes X-Treme Clean™ XP casing brush is a durable tool designed for deepwater, deep, and deviated well applications. It is used to brush and clean the interior diameter (ID) of casing and remove scale, rust, mud residue, and any other particles of debris. The tool can be run by itself or as an integral part of a complete wellbore cleaning and displacement system with circulation tools, scrapers, magnets, filters, and bit.

The casing brush features a one-piece mandrel design without any internal connections. The tensile and torque ratings of the tool are higher than those of the tool joint. This allows the tool to be used in deepwater wells, deep wells, or deviated wells in which higher tensile and torque rating are required.

One feature of the tool is its high allowable rotation speed. Allowing drillpipe to rotate up to 150 rpm significantly increases the cleaning efficiency and allows the tool to be used in the drilling or milling applications in which a high rotational speed is required.

The tool also provides large ID and annulus flow areas. It allows more effective circulation and displacement operations.

The non-rotational stabilizers and brush sleeve, plus the field-proven brush technology, prevent wear or damage to the casing wall, while allowing for maximum casing ID cleaning in straight or high-angled holes. The brush is not vulnerable to chemical or acid attack.

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Specifications

- Tensile rating: higher than the tensile rating of tool joints
- Torque rating: higher than the torque rating of tool joints
- Allowable rotation speed: 150 rpm

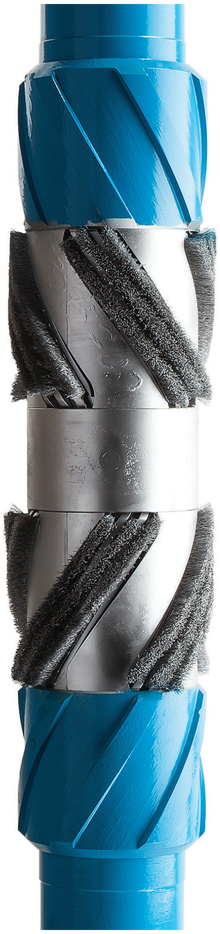
Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to learn how our X-Treme Clean XP casing brush can effectively clean casing with high-performance tools.

Applications

- Deepwater wells
- Deep wells
- Deviated wells
- Extended-reach wells
- Wells with high dogleg severity

Features and Benefits

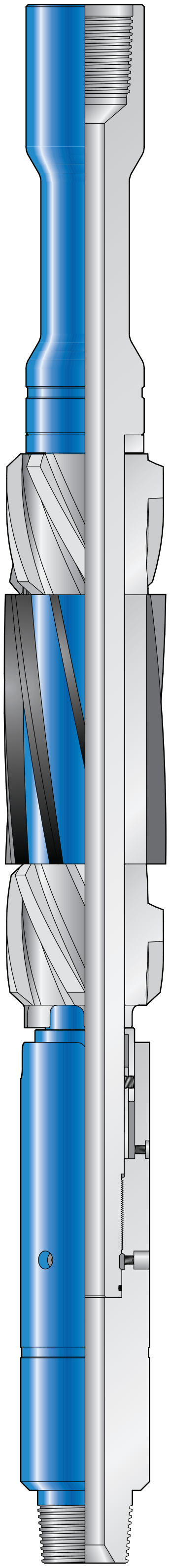
- One-piece mandrel design with higher-than-tool-joints tensile and torque ratings
  - Significantly mitigates completion and production risks and costs
- Non-rotating stabilizers and brushes
  - Effectively cleans well without damaging or wearing casing wall
- Highest allowable rotation speed of 150 rpm
  - Increases cleaning efficiency
- Large circulation areas
  - Improves circulation and displacement efficiency
- 360° casing coverage with helical brush
  - Increases cleaning efficiency
- No exposed fasteners that could vibrate loose
  - Improves operational reliability



The X-Treme Clean™ XP casing brush contains stainless steel brushes laid out in a helical pattern for optimal cleaning efficiency.

Brush trim length is verified as part of the inspection process for each job.

Casing Cleaning Tools



X-Treme Clean™ EP ULTRA-CLEAN™ casing brush
Product family no. H16108

EP ULTRA-CLEAN Casing Brush

Effectively clean casing ID

The Baker Hughes X-Treme Clean™ EP ULTRA-CLEAN™ casing brush is used in conjunction with a casing scraper to further brush and clean casing inner diameter (ID). It is designed to remove scale, rust, mud residue, and any other particles of debris.

The tool can be run by itself or as an integral component of the wellbore cleanup or displacement system. It features self-centering, nonrotational stabilizers to keep the nonrotating brush sleeve centered in the hole, preventing wear or damage to the casing. This ensures 360° brush coverage and eliminates uneven brush wear while allowing for rotation of the heavy-duty main mandrel in straight and high-angle holes.

Another benefit is a special safety clutch that can be activated if the brush gets stuck. This allows torque to be transferred to the entire tool for working it free or washover contingencies if that becomes necessary. The tool is designed with ample circulation area to allow for high-rate circulation and bypass of debris.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP ULTRA-CLEAN casing brush helps you effectively clean your casing ID.

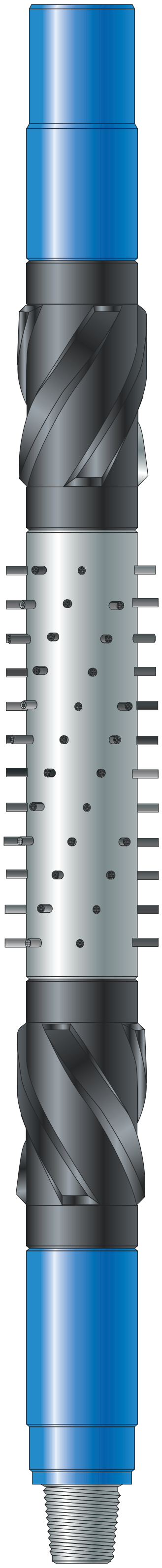
Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement

Features and Benefits

- Nonrotating stabilizers and brushes
  - Eliminates risk of damaging to casing when rotating or drilling
- Safety clutch design
  - Allows tool to work free if stuck in hole
- No external fasteners
  - Avoids leaving parts downhole
- Brush with 360° coverage
  - Provides high cleaning effectiveness

The X-Treme Clean™ EP casing brush can be used with the casing scraper to remove scale, rust, mud residue, and other debris from the casing ID.



X-Treme Clean™ WELL-CLEAN casing brush
Product family no. H16113

EP WELL-CLEAN Casing Brush

Effectively clean casing ID with 360-degree brush contact

The Baker Hughes X-Treme Clean™ WELL-CLEAN casing brush scours the inside of casing during displacement operations using interchangeable, self-centralizing, full-gauge centralizers that maximize brush sleeve contact with the casing surface throughout the cleaning operation.

This brush is heavy duty: the bristle sleeve is manufactured of carbon steel alloy, and the tool body is made of heavy-duty API tool steel. Hardened and tempered spring-steel bristle plugs are inserted into the alloy sleeve.

A modified cup design locks the bristle plugs in place while the tool is deployed during well cleaning operations. The appropriate number and placement of brushes for optimized wellbore cleaning operations is calculated by Baker Hughes completion specialists.

Contact your Baker Hughes representative today to find out how our X-Treme Clean WELL-CLEAN casing brush helps you effectively clean your casing ID.

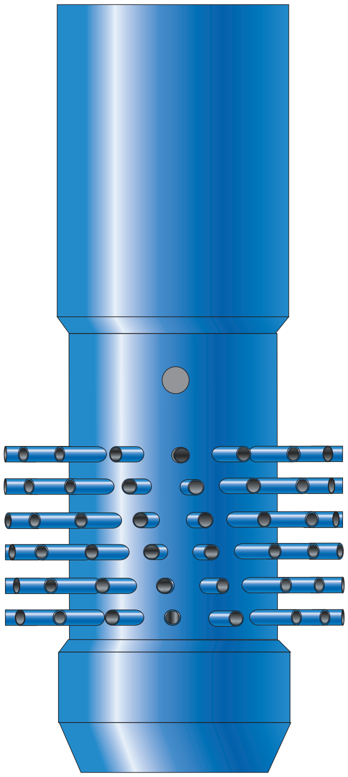
Applications

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement

Features and Benefits

- Unique bristle sleeve and stabilizer design
  - Ensures 360° contact
  - Allows for simple field redress
- Optimized brush bristles
  - Resist deformation and wear through length, density, and stiffness
- Heavy-duty steel construction
  - Withstands rotation and reciprocation for long periods of time
- High-torque connections
  - Minimize crossovers
- No external screws, bolts, or blocks
  - Eliminates risk of parts working loose under extreme operating conditions

Casing Cleaning Tools



Disposable casing brush
Product family no. H16115

EP Disposable Casing Brush

Ensure casing cleanliness during equipment installation

The Baker Hughes disposable casing brush is a mechanical wellbore cleanup tool used to ensure cleanliness while installing temporary or permanent downhole equipment. The simple design allows it to connect directly below the tool, which allows casing cleaning and tool placement to be performed in a single run.

The bristles in the brush are configured to provide 360° coverage in the casing. The rotating and reciprocating capabilities ensure that debris can be cleaned in a variety of applications. For applications requiring drilling out, the plug is available in drillable alloy.

The disposable casing brush is available for casing in sizes from 4$^1/_2$ in. to 13$^3/_8$ in.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes disposable casing brush helps you reduce nonproductive time.

Applications

- Unconventional hydrocarbon
- Conventional oil and gas
- Deep water

Features and Benefits

- Made up directly below plug, packer, or cement retainer tool
  - Provides additional casing cleaning
  - Provides completion and workover insurance
- Unique bristle design and placement
  - Provides 360° casing coverage
  - Ensures more effective cleaning
- Can be rotated and/or reciprocated
  - Cleans more effectively

Circulation Swivels and Subs

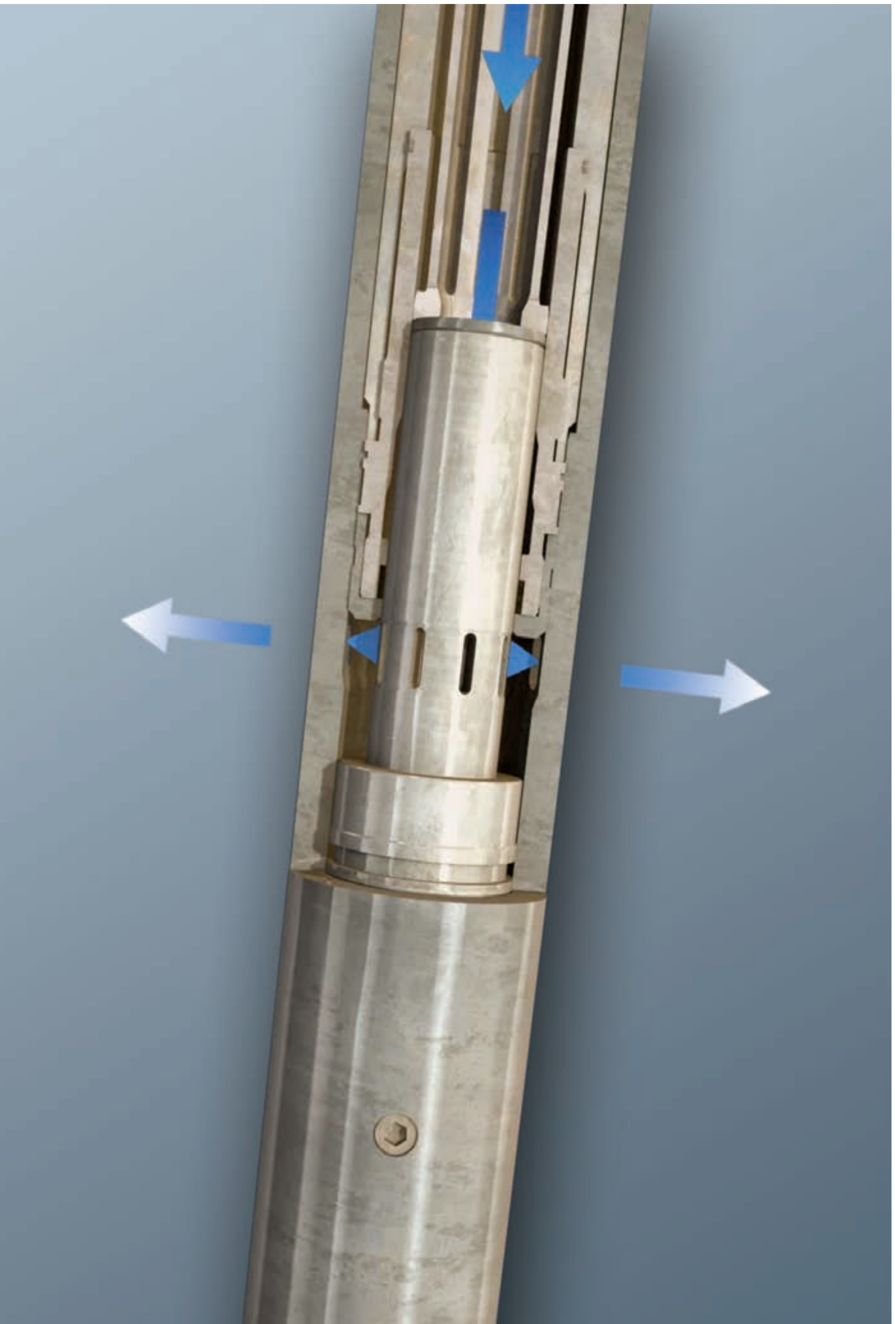
XP Multi-Cycle Ball-Activated Circulation Valve

EP J-Type Circulation Swivel

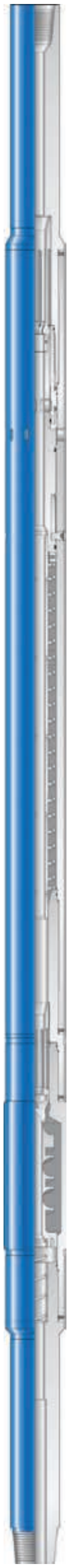
EP Full-Function Valve

EP Pump-Out Sub

SP Circulation Control Joint



Circulation Swivels and Subs



X-Treme Clean™ XP multi-cycle ball-activated circulation valve
Product family no. H14072

XP Multi-Cycle Ball-Activated Circulation Valve

Conduct mid-string circulation during drilling and wellbore cleanup

The Baker Hughes X-Treme Clean™ XP multi-cycle ball-activated circulation valve is a hydraulically-activated tool that enables mid-string circulation during wellbore cleanup, fluid displacement, and drilling. The valve can be used in deepwater cased hole displacement and wellbore cleanup to boost annular velocity to improve debris removal and perform blowout preventer cleaning. In drilling operations the valve can be used to clean debris or to spot chemicals or lost circulation material (LCM). Because it is hydraulically activated, the valve is also suitable for scenarios where mechanical operation is not feasible.

In cased hole displacement and wellbore cleanup applications, the circulation valve can be run as part of the complete X-Treme Clean wellbore cleanup system. In drilling applications, the valve is typically run in the bottomhole assembly above under-reamers and measurement while drilling (MWD) tools.

The valve provides three flow modes: to the bit, to the ports only, and flow split through bit and ports. In run-in position, all flow is directed through the bit. Depending on your application, the tool's secondary flow path can be reconfigured by first dropping the right-sized ball. For example, during drilling operations, if LCM is to be spotted, the tool can be activated to the port open-only position to avoid any flow through the debris-sensitive measurement devices below the circulation valve. If there is a need to boost annular velocity for debris removal, a different-sized ball can be dropped to activate the tool while maintaining a split flow path. In this configuration, some of the fluid will exit the ports while some will continue through the bit.

To operate the valve, a ball is dropped from surface to shift the internal sleeve, opening the ports for circulation. Depending on the size of the ball dropped, the tool's flow path to the bit will either be closed off or left open. Dropping a second ball returns the internal sleeve to its run-in position, sealing off the ports and allowing circulation through the tools. All balls are stored within the circulation valve in the integrated ball catcher sub, eliminating the need for additional catcher tools to be run in the string.

This tool has multiple cycles and is limited in cycles only by the capacity of the integrated ball catcher sub. The tool also has a full internal flow path that allows smaller balls to be circulated through for activating or deactivating any tools below. Additionally, the circulation valve is designed with high torque and tensile ratings, making it ideal for deepwater and ultra deepwater operations.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean XP multi-cycle ball-activated circulation valve can help you successfully perform high rate circulation operations in either completion or drilling applications.

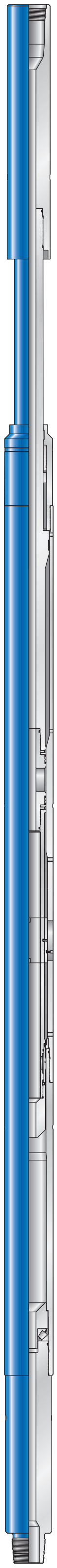
Applications

- Conventional oil and gas
- Deep water
- Deviated and horizontal wells
- Displacement
- Wellbore cleanup
- Removing debris or spotting chemicals/fluids while drilling
- Any application requiring circulation through the mid-string

Features and Benefits

- Multiple cycles
  - Performs multiple operations in one trip
  - Reduces nonproductive time
- Hydraulically activated
  - Eliminates need for set-down weight
  - Improves reliability
- Large circulation ports
  - Enables high flow rates
- Three flow modes
  - Provides flexibility for different applications

Circulation Swivels and Subs



J-Type™ circulation swivel
Product family no. H14146

EP J-Type Circulation Swivel

Complete multiple high-rate circulation operations in one trip

The Baker Hughes J-Type™ circulation swivel is normally used to locate at a known point, such as a liner top, to address applications requiring circulation through the mid string. It is specially designed for multiple high-volume circulation operations in displacement and wellbore cleanup jobs.

The J-Type circulation swivel is a mechanically set tool with unlimited operation cycles. In the closed position, it allows fluid flow and torque to be fully transmitted through the tool. Right-hand rotation while applying set-down weight moves the J-Type circulation swivel to the open position, which allows for high-volume circulation through its ports and acts as a swivel to keep the tool below from rotating. Straight set-down position without right-hand rotation allows the weight to be transmitted to the tool below so that a packer or other tools can be set below.

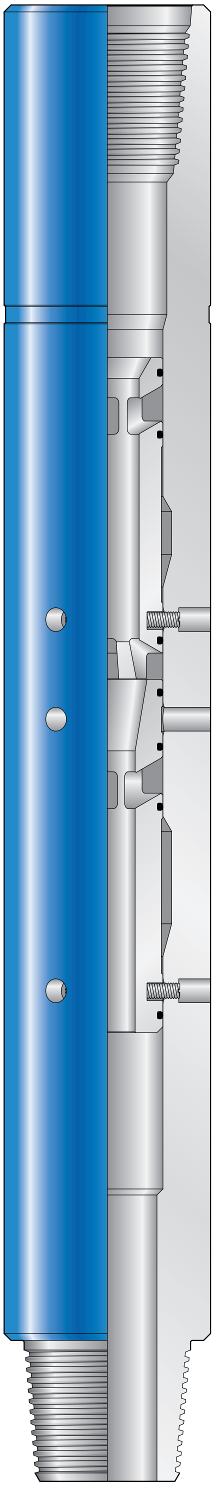
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes J-Type circulation swivel helps you with displacement and wellbore cleanup applications.

Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Deviated and horizontal wells
- Displacement
- Wellbore cleanup
- Any application requiring circulating through the mid string

Features and Benefits

- Mechanical-set with unlimited cycles
  - Allows multiple operations in one trip
  - Reduces nonproductive time
- Allows for rotation of entire string or only above the tool
  - Protects lower string from torque damage, especially for horizontal and deviated wells
- No drop balls or darts required
  - Provides easy and reliable operation



Full-function valve
Product family no. H14079

EP Full-Function Valve

Provide additional well control with full-cycle circulation

The Baker Hughes full-function valve allows direct circulation to annulus to boost annular flow rate or to avoid pulling a wet string. The valve's simple design (main body, upper piston, lower piston, and shear screws) results in easy and reliable operation. In the event of a well kick-in, the valve can be shifted to closed position to perform further well control operations.

When needed, a ball is dropped down the drillstring to the lower piston. Additional pump pressure shears the lower piston, allowing circulation through the bottom and through the side ports to the annulus. An additional ball can be dropped to shear the upper piston, which will seal the circulation ports and direct all flow through the drillstring below.

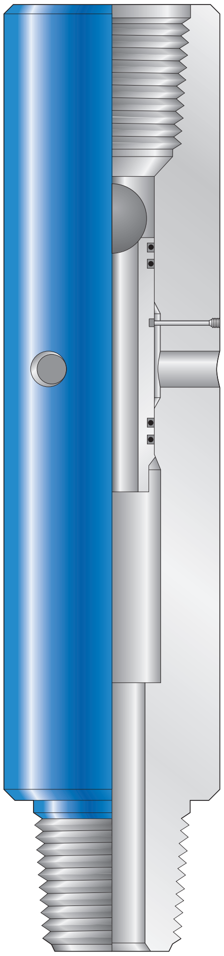
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes full-function valve provides better circulation and well control.

Applications

- Heavy oil
- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement
- Any application requiring circulating through the mid string

Features and Benefits

- Two pistons activated by two balls
  - Allows for circulation through the ports to annulus or through the string below
  - Provides additional well control
- Simple to operate
  - Improves reliability



Pump-out sub
Product family no. H14061

EP Pump-Out Sub

Mitigate operational risk through mid-string circulation

The Baker Hughes pump-out sub allows circulation in the mid string to avoid pulling a wet string and to provide well control. The valve's simple design results in easy and reliable operation.

When needed, a ball/plug can be dropped to shift open the valve, allowing circulation through the ports.

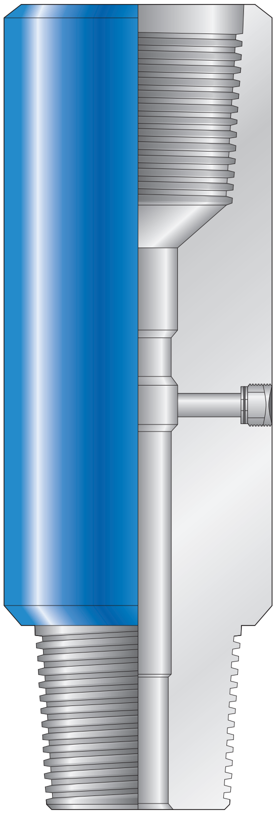
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes pump-out sub helps you reduce operational risk.

Application

- Heavy oil
- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement
- Fishing
- Any application requiring circulating through the mid string or avoiding pulling wet string

Features and Benefits

- Simple to operate with one ball/plug
  - Improves reliability
- Large flow area
  - Allows full flow



Circulation control joint
Product family no. H14024

SP Circulation Control Joint

Provide simple and reliable circulation solution

The Baker Hughes circulation control joint is a multipurpose tool that provides a means of establishing circulation at a predetermined hydraulic pressure. It can be used as a pump-out, kick, run-in, or drain sub by varying the particular control washer/rupture disc/restriction plug combination.

The standard circulation control joint has an inner bore profile that forms a seat for restriction plugs fitted with a bit nozzle. The control washer and bit nozzle inner diameters (IDs) can be varied to obtain the correct relationship between mud flow and pressure drop to burst the rupture disc and establish the desired flow rate. The circulation port can be resealed at any time by removing the standard restriction plug (short fishneck) and inserting an extended (long fishneck) restriction plug. Both restriction plugs can be recovered with slickline using a restriction plug spear.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes circulation control joint can help you control your circulation efforts more efficiently.

Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Fishing operations
- Wellbore cleanup
- Displacement

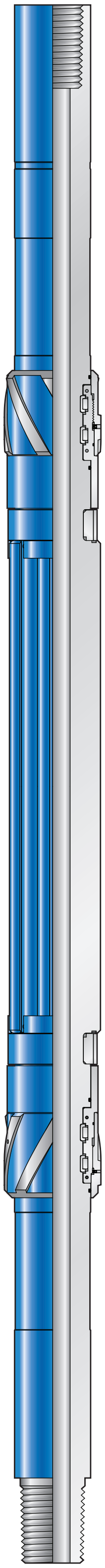
Features and Benefits

- Provides a circulation point if a tool string is plugged
    - Eliminates pulling a wet string
- Can be used as a drain or kick sub
    - Adds flexibility
- Contains a large ID for circulation and backoff tools
    - Improves operation
- Maintains same rupture pressure from both sides of the disc
    - Reduces operation risk

Notes

Debris Recovery

XP Downhole Magnet
EP WELL-CLEAN Downhole Magnet
EP Grabitz Magnet
XP Multitask Wellbore Filter
EP Multitask Wellbore Filter
EP WELL-CLEAN Element-Style Boot Basket
SP Washpipe Boot Basket
SP Type B Boot Basket
SP Globe-Type Junk Basket
SP Internal Boot Basket



X-Treme Clean™ XP downhole magnet
Product family no. H13104

XP Downhole Magnet

Recover metal debris from wellbore with high-strength magnets

The Baker Hughes X-Treme Clean™ XP downhole magnet for deepwater, deep, and deviated well applications contains high-strength magnets that collect metal from the wellbore fluid and recover it to the surface. It removes ferrous metal debris left in the wellbore such as debris from window cutting, packer milling, or junk milling. It can be used by itself, with blowout preventer jet subs for blowout preventer cleaning, with VACS™ tools for downhole debris collection, or with other casing cleaning tools such as circulation subs, scrapers, brushes, and multi-task wellbore filters for wellbore cleaning and displacement.

The downhole magnet features one-piece mandrel design without any internal connection. The tensile and torque ratings of the tool are higher than those of the tool joint, which allows the tool to be used in deepwater wells, deep wells, or deviated wells in which higher tensile and torque ratings are required.

The high-temperature, high-strength magnets and unique magnet arrangement provide extraordinary metal debris capturing and carrying capability that is many times higher than a conventional tool, even in a high-pressure/high-temperature (HP/HT) well. The design lets metal debris tightly collect in the space between the magnetic bars, which allows adequate circulation area between the tool outside diameter and casing inside diameter. The robust replaceable magnet bars can withstand harsh downhole environments and allow easy assembly, replacement, and tool cleaning.

The stabilizers at both ends of the tool centralize the tool and allow more effective circulation in the deviated wells. Allowing drillpipe to rotate up to 150 rpm could significantly increase cleaning efficiency and would also allow the tool to be used in the drilling or milling applications in which a high rotational speed is required.

The tool also provides large inside diameter and annulus flow areas. It allows more effective circulation and displacement operations.

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Specifications

- Tensile rating: higher than the tensile rating of tool joints
- Torque rating: higher than the torque rating of tool joints
- Allowable rotation speed: 150 rpm

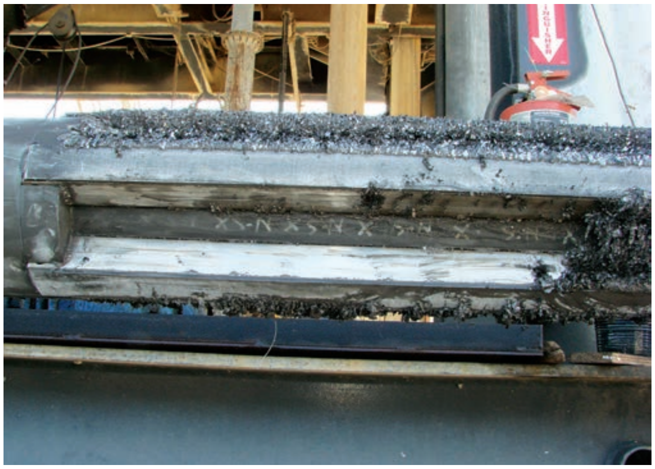
Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to learn how our X-Treme Clean XP downhole magnet can effectively recover ferrous debris from your well.

Applications

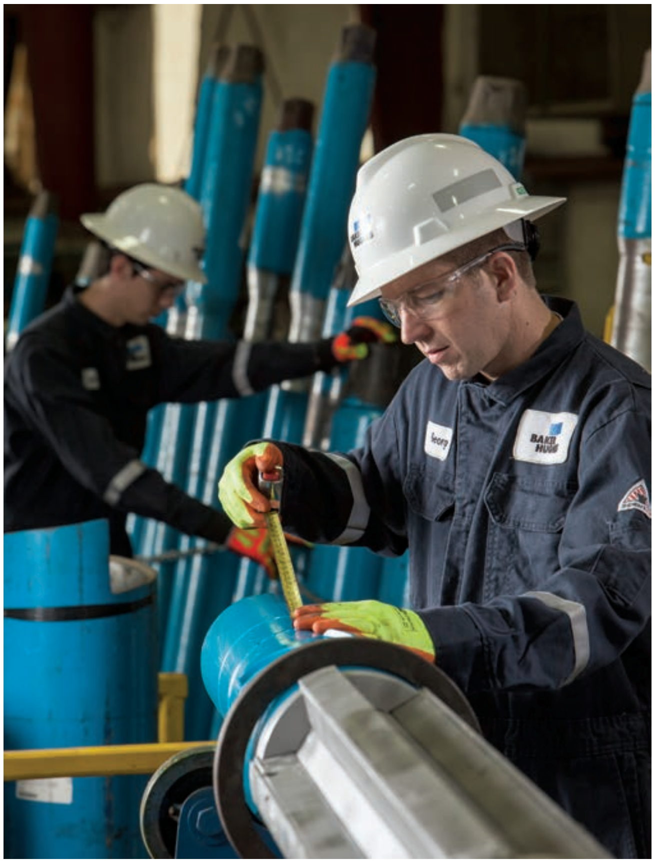
- Deepwater wells
- Deep wells
- Deviated wells
- Extended-reach wells
- HP/HT wells
- Wells with high dogleg severity
- Wells with excessive metal debris

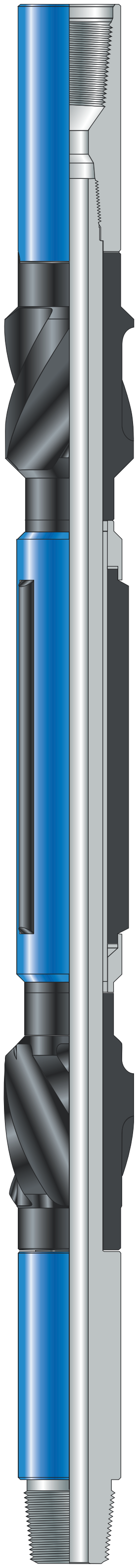
Features and Benefits

- High-strength rare earth magnets and unique magnet arrangement
  - Provides superior metal debris collecting capability
- One-piece mandrel design with higher-than-tool-joints tensile and torque ratings
  - Provides a reliable and effective tool to clean wellbores and significantly mitigates completion and production risks and costs
- Highest allowable rotation speed of 150 rpm
  - Increases cleaning efficiency
- Non-rotating stabilizers
  - Effectively cleans well without damaging or wearing casing wall
- Large circulation areas
  - Improves circulation and displacement efficiency
- No exposed fasteners that could vibrate loose
  - Improves operational reliability



The X-Treme Clean™ XP magnet offers superior debris-removing capability during wellbore cleanup operations.





X-Treme Clean™ WELL-CLEAN downhole magnet
Product family no. H13103

EP WELL-CLEAN Downhole Magnet

Minimize NPT by removing ferrous metal debris from the wellbore

The Baker Hughes X-Treme Clean™ WELL-CLEAN downhole magnet is run with WELL-CLEAN casing brushes and centralized casing scrapers to remove ferrous metal debris during well cleaning to prepare for completion hardware installation. It can be used as an integral component of the a debris removal system during post-perforation operations.

This heavy-duty, extra-large-debris-capacity tool removes metallic debris in difficult well configurations such as liner tops and in highly deviated wellbores. It can also be used for fishing, displacement, and debris recovery during and after milling.

The magnet has a simple, rugged mandrel design. It can be used in wells with low annular velocities, wells that contain fluids with poor carrying capacities, and in wells where circulation is a problem.

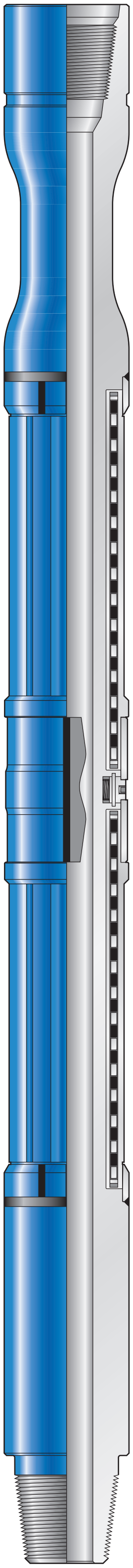
Contact your Baker Hughes representative today to find out how our X-Treme Clean WELL-CLEAN downhole magnet helps you minimize NPT by removing ferrous metal debris from the wellbore.

Applications

- Unconventional hydrocarbons
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Displacement
- Fishing

Features and Benefits

- Heavy-duty steel construction
  - Withstands rotation and reciprocation for long periods
- High-torque connections
  - Minimize crossovers
- Contains no external screws, bolts, or blocks
  - Eliminates risk of parts working loose under extreme operating conditions



X-Treme Clean™ EP Grabitz™ magnet
Product family no. H13101

EP Grabitz Magnet

Remove ferrous metal debris from wellbore effectively

The Baker Hughes X-Treme Clean™ EP Grabitz™ magnet is used to collect ferrous metal debris from the wellbore and well fluids and then retrieve it to surface. It has the versatility to be used in a variety of applications such as fishing, wellbore cleanup, displacement, and debris recovery during and after milling.

It also can be used in conjunction with other wellbore cleanup tools such as the Baker Hughes X-Treme Clean EP ULTRA-CLEAN™ casing scraper and X-Treme Clean EP ULTRA-CLEAN brush sub to perform displacement or wellbore cleanup operations.

The magnet is designed with a one-piece, full-strength mandrel, which reduces risks in the wellbore. Its high-pressure/high-temperature (HP/HT) capability makes it ideal for extreme conditions, but the tool also is used in wells with low annular velocities, wells that contain fluids with poor carrying capacities, and in wells where circulation is a problem.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP Grabitz magnet helps you remove metal debris from your wells.

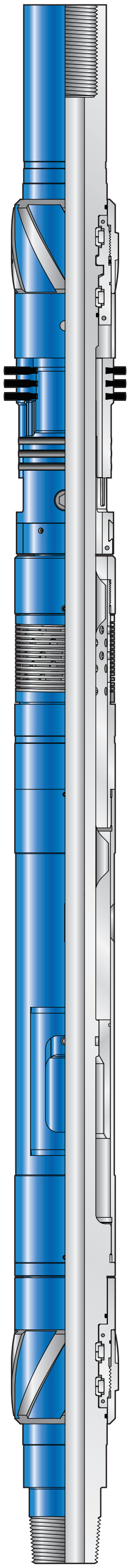
Applications

- Conventional oil and gas
- Unconventional hydrocarbons
- Deep water
- HP/HT
- Displacement
- Wellbore cleanup
- Debris recovery
- Fishing

The X-Treme Clean™ EP Grabitz™ magnet is used to collect ferrous debris in the wellbore and carry it to surface.

Features and Benefits

- Collects metal debris downhole and retrieves them to surface
  - Ensures well cleanliness
- Easily cleaned and disassembled for inspection
  - Reduces nonproductive time
- One-piece, full-strength mandrel
  - Improves reliability
- No external nuts and bolts
  - Eliminates risk of leaving parts in hole
- HP/HT capable
  - Is applicable for a wide variety of applications



X-Treme Clean™ XP multitask wellbore filter
Product family no. H13023

XP Multitask Wellbore Filter

Collect debris, clean, and filter fluid in one trip

The Baker Hughes X-Treme Clean™ XP multitask wellbore filter for deepwater, deep, and deviated well applications collects debris from the wellbore wall, brushes off the wellbore wall and filters the fluid, all in one run. It is a modular tool and can be run by itself, with blowout preventer (BOP) jet sub and riser brush and boot basket for BOP and riser cleaning, or as an integral part of a complete wellbore cleaning and displacement system with circulation tools, scrapers, brushes, and magnets.

It is primarily for use in pre-completion stages to clean the riser, BOP, and wellbore, and assist the fluid displacement, but can be run any time the wellbore has become contaminated with debris, such as after a milling operation.

The multitask filter features one-piece mandrel design without any internal connection. The tensile and torque ratings of the tool are higher than those of the tool joint. This allows the tool to be used in deepwater wells, deep wells, or deviated wells in which higher tensile and torque ratings are required.

The tool features a high allowable rotation speed. Allowing drillpipe to rotate up to 150 rpm significantly increases cleaning efficiency and allows it to be used in the drilling or milling applications in which high rotation is required.

The tool also provides a large inside diameter and annular flow areas. It allows more effective circulation and displacement operations.

The slidable brush design provides a large bypass flow area when running in hole, and diverts flow and allows more effective debris collection when pulling out of hole. The patent-pending debris-removal window allows simple debris-removal operation.

This tool uses field-proven screen technology that provides effective fluid filtering in harsh downhole environments.

The X-Treme Clean XP multitask filter is ruggedly designed and is ideal for deepwater, deep well, deviated well, extended-reach well, and high dogleg severity well applications.

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Specifications

- Tensile rating: higher than the tensile rating of tool joints
- Torque rating: higher than the torque rating of tool joints
- Allowable rotation speed: 150 rpm

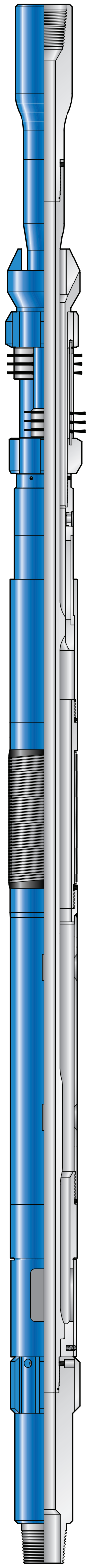
Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to learn how our X-Treme Clean XP multitask wellbore filter can effectively collect debris, clean, and filter fluid in one trip.

Applications

- Deepwater wells
- Deep wells
- Deviated wells
- Extended-reach wells
- Wells with high dogleg severity

Features and Benefits

- One-piece mandrel design with higher-than-tool-joints tensile and torque ratings
  - Significantly mitigates completion and production risks and costs
- Non-rotating stabilizers
  - Effectively cleans well without damaging or wearing casing wall
- Highest allowable rotation speed of 150 rpm
  - Effectively cleans the wells without damaging or wearing casing wall
- Large circulation areas
  - Improves circulation and displacement efficiency
- No exposed fasteners that could vibrate loose
  - Improves operational reliability
- 360° coverage with slidable brush assembly
  - Provides large bypass flow area and more effective debris collection
- Patent-pending debris-removal window
  - Allows simple debris-removal operation at rig floor
- Field-proven screen technology
  - Provides effective fluid filtering in harsh environments



X-Treme Clean™ EP multitask wellbore filter
Product family no. H13015

EP Multitask Wellbore Filter

Clean and filter wells in one trip

The Baker Hughes X-Treme Clean™ EP multitask wellbore filter allows brushing of debris from the wellbore wall, filtering the fluid, and recovering debris, all in one trip. This tool can be run in conjunction with other Baker Hughes wellbore cleanup tools to perform displacement and wellbore cleanup operations.

The filter is usually used during the precompletion stage, but it can be run any time the wellbore is contaminated with debris. It is commonly used as a key point indicator to verify cleanliness of the wellbore.

When run in hole, the tool acts as a boot basket, collecting large debris when fluids pass through the filter. When pulled out of hole, the bypass is closed and the tool diverts fluid through the filter media capturing the debris; once at surface, the debris can be conveniently removed at rig floor and the tool is ready to be immediately returned downhole. A large quantity of debris recovered indicates that another trip is needed to more thoroughly clean the wellbore.

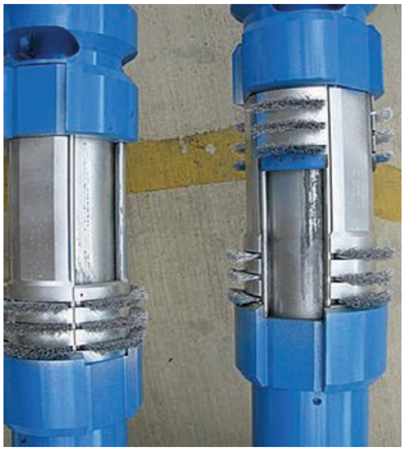
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP multitask wellbore filter helps you clean and filter your wells in one trip.

Application

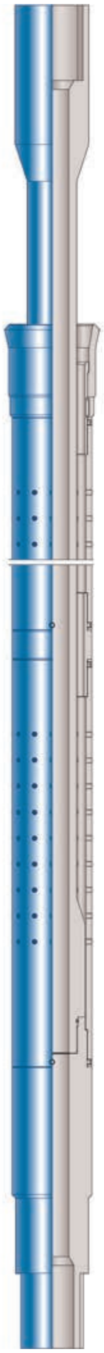
- Conventional oil and gas
- Deep water
- Displacement
- Wellbore cleanup
- Debris recovery

Features and Benefits

- Large bypass area
  - Allows fast run-in
- Extensions to basket and mandrel can be added
  - Improves debris-carrying capability
- Large cleanout windows with easy access
  - Allows simple debris-removal operation at rig floor
  - Reduces nonproductive time
- Uses field-proven Baker Hughes screen/slotted liner technology
  - Increases reliability and improves performance



One configuration of the X-Treme Clean™ EP mutlitask wellbore filter uses a sliding brush design to divert fluid and debris into the basket.



X-Treme Clean™ WELL-CLEAN element-style boot basket
Product family no. H13025

EP WELL-CLEAN Element-Style Boot Basket

Recover debris during riser and BOP cleaning operations

The X-Treme Clean™ well cleaning WELL-CLEAN element-style boot basket, an integral part of the Baker Hughes wellbore cleanup (WBCU) system, collects debris during riser and blowout preventer (BOP) jetting operations. The boot basket's rubber cup directs captured debris into the ported filter, which prevents debris from entering the wellbore.

Normally positioned below the fluid-actuated jetting tool, the boot basket can be rotated or reciprocated during jetting operations to ensure optimal BOP cleaning. The boot basket is typically used during the precompletion stage during jetting operations, but it can be run any time the wellbore is contaminated with debris. It can also be used as a key point indicator to verify cleanliness of the wellbore. This tool can be run in conjunction with other Baker Hughes WBCU tools to perform multiple wellbore cleanup operations.

Contact your Baker Hughes representative today to find out how our X-Treme Clean WELL-CLEAN element-style boot basket helps you filter debris from your well during jetting or sand control operations.

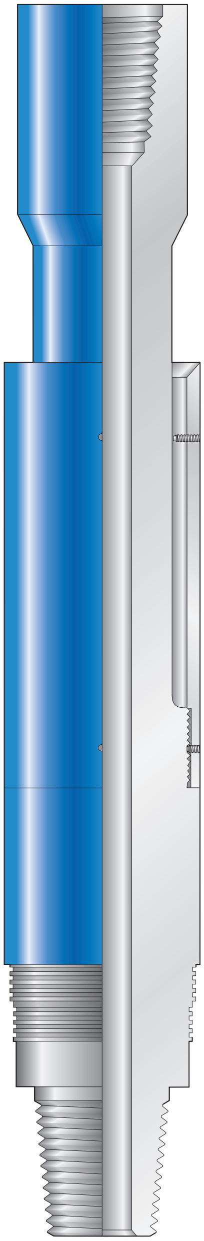
Applications

- Riser and BOP jetting operations
- Displacement
- Wellbore cleanup
- Debris recovery

Features and Benefits

- Simple design and operation
  - Directs debris into the debris catcher for filtering
- Rugged ported filter
  - Allows circulation while preventing debris from entering the wellbore
- High-temperature reinforced packer cups
  - Can be rotated and/or reciprocated during circulation
  - Eliminate downtime caused by debris left in the wellbore
  - Wipe casing while running in and out of the wellbore

Debris Recovery



Washpipe boot basket
Product family no. H13019

SP Washpipe Boot Basket

Recover debris reliably and economically

The Baker Hughes washpipe boot basket has multiple functions in a washover assembly—like the standard boot basket, it traps debris too large to be circulated out. The washpipe connection eliminates the need for a crossover brushing. The washpipe boot basket with the third inner connection is used for packer milling and recovery operations. In both operations, components of the bottomhole assembly (BHA) are eliminated, reducing the risk of BHA failure.

It is available in 4 1/2-in., 5 3/4-in., and 8 3/8-in. outside diameters, and the inner connections are available with eight round or packer retrieving tool connections. The washpipe boot basket should be run as close as possible to the mill. Additional boot baskets can be run in tandem to increase the junk-catching capacity.

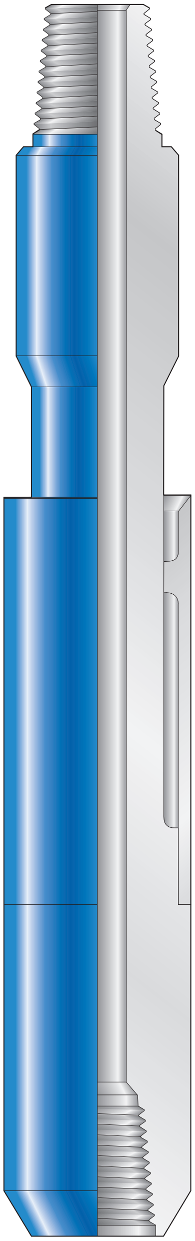
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes washpipe boot basket helps you recover large debris.

Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Wellbore cleanup
- Fishing
- Debris recovery

Features and Benefits

- Reduces crossovers in workstring
  - Increases reliability
- Simple design with no moving parts
  - Ensures easy and reliable operation
- High torsional and buckling strength
  - Reduces operating risk



Type B™ boot basket
Product family no. H13016

SP Type B Boot Basket

Remove debris economically and reliably

The Baker Hughes Type B™ boot basket traps debris that is too large to circulate out of the hole during drilling, milling, or junk fishing operations. The boot basket traps junk by producing a sudden decrease in annular velocity when the debris passes the larger outside diameter (OD) of the boot, reaching the smaller OD of the body and top connection.

It is normally run as close as possible to the mill, bit, or junk basket. Additional boot baskets can be run in tandem to increase the junk-catching capacity. The boot baskets are constructed from heat-treated alloy steel and can be ordered with 18-in- (457.2-mm) or 36-in.- (914.4-mm) long baskets.

The Type B boot basket is available in sizes from 1⁴/₅-in. to 13³/₈-in. OD.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes Type B boot basket helps you recover large debris.

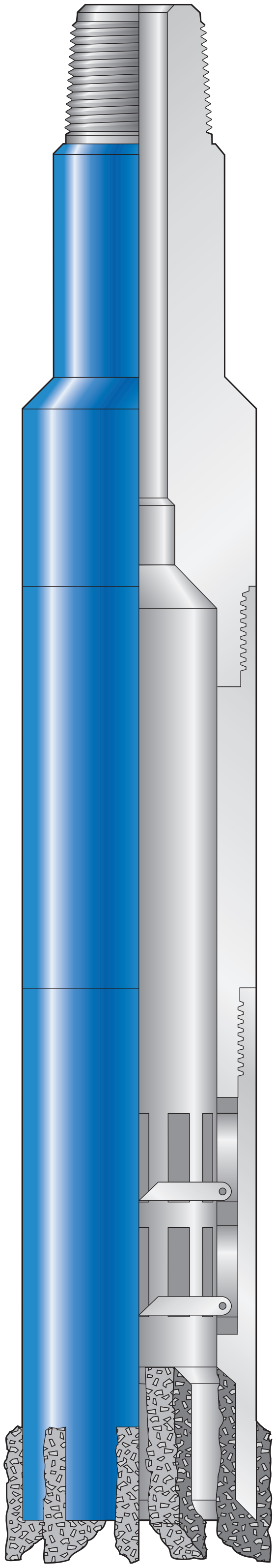
Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Wellbore cleanup
- Fishing
- Debris recovery

Features and Benefits

- Simple design with no moving parts
  - Ensures easy and reliable operation
- High torsional and buckling strength
  - Reduces operating risk
- Box-down, pin-up design
  - Allows boot basket to be run directly above a mill or bit

Debris Recovery



Globe-type junk basket
Product family no. H13022

SP Globe-Type Junk Basket

Recover debris with cost-effective solution

The Baker Hughes globe-type junk basket is used to recover debris and other objects in the wellbore. The simple and robust design has been proved by many successful operations around the world. With the addition of the Baker Hughes VACS™ engine component, the globe-type junk basket can be turned into a Baker Hughes VACS junk catcher.

The reverse circulation through the bottom of the tool circulates debris and objects from the bottom of the hole and traps the large debris in the catcher fingers. The junk can then be pulled to surface and recovered.

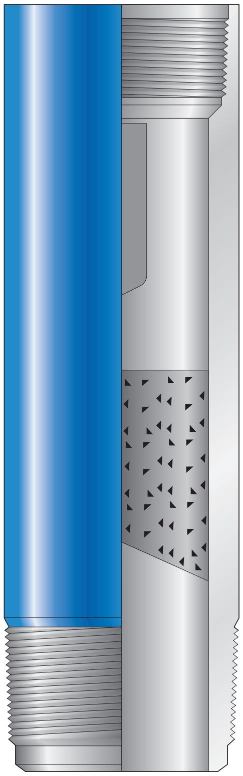
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the globe-type junk basket can help you recover objects in the wellbore.

Applications

- Unconventional hydrocarbons
- Conventional oil and gas
- Fishing
- Wellbore cleanup
- Debris recovery

Features and Benefits

- Simple and robust design
  - Provides easy and reliable operation
- Does not require a ball to operate
  - Reduces operational risk
- Double set of free-rotating finger catchers
  - Improves reliability with its field-proven design



Internal boot basket
Product family no. H13021

SP Internal Boot Basket

Recover fine or small debris with cost-effective solution

The Baker Hughes internal boot basket provides an economic solution to recover fine or small debris in the wellbore. The simple and robust design has been proved by many successful operations around the world.

The reverse circulation through the bottom of the tool circulates debris from the bottom of the hole and traps it in the catcher. The debris can then be pulled to surface and recovered.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes internal boot basket helps you clear the smallest debris from your wells more efficiently.

Application

- Unconventional hydrocarbons
- Conventional oil and gas
- Fishing
- Wellbore cleanup
- Debris recovery

Features and Benefits

- Simple and robust design
  - Provides easy and reliable operation
- No moving parts
  - Reduces operational risk
- Can be manufactured with any washpipe size or connection
  - Adds flexibility

Notes

Riser and BOP Cleaning

XP Riser Brush and Boot Basket

EP Riser Brush and Boot Basket

XP Full-Cycle Ball-Activated BOP Jet Sub

EP BOP Jet Sub

EP Surface Junk Catcher

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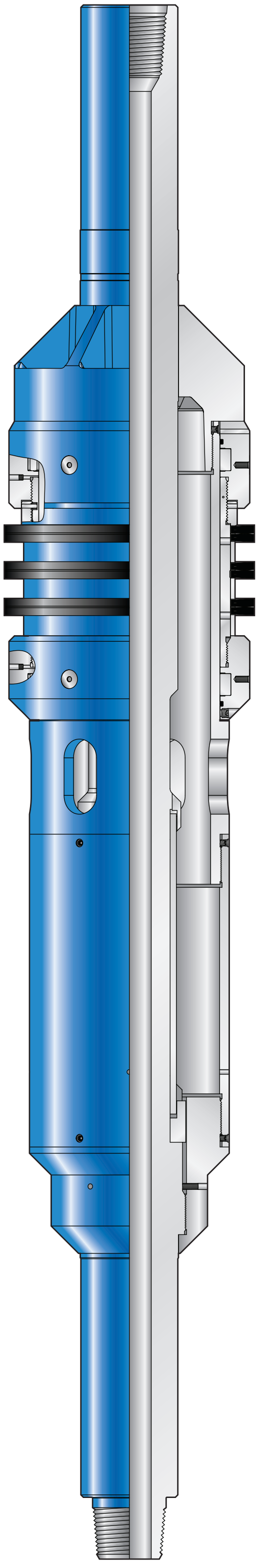
Riser and BOP Cleaning



X-Treme Clean™ XP
riser brush and boot basket
Product family no. H13024

XP Riser Brush and Boot Basket

Clean riser effectively for deepwater applications

The Baker Hughes X-Treme Clean™ XP riser brush and boot basket is for deepwater applications used to clean the interior casing wall of drilling and production riser systems. It brushes and wipes mud residue, cement, or other debris from the riser inside wall and recovers them to surface. Recovery is done with a boot basket that is designed in with the brush assembly and built on a robust mandrel that is full drillpipe strength.

The riser brush and boot basket features one-piece mandrel design without any internal connection. The tensile and torque ratings of the tool are higher than those of the tool joint.

One feature of the tool is its high allowable rotation speed. Allowing drillpipe to rotate up to 150 rpm significantly increases the cleaning efficiency and also allows the tool to be run in the same trip with casing cleaning string, eliminating a dedicated riser cleaning run.

The non-rotational brush sleeve and the improved brush robustness prevent wear or damage to the riser inside diameter (ID), while allowing for maximum riser ID cleaning.

The tool has no welding on any non-consumable parts. This feature reduces inspection cost and time in deepwater applications and considerably increases operation reliability.

The basket with built-in magnets captures debris, especially metal debris, effectively. The X-Treme Clean XP riser brush is ruggedly designed and is ideal for deepwater applications.

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Riser and BOP Cleaning

Specifications

- Tensile rating: higher than the tensile rating of tool joints
- Torque rating: higher than the torque rating of tool joints
- Allowable rotation speed: 150 rpm

Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to learn how our X-Treme Clean XP riser brush and boot basket can effectively clean riser systems in deepwater wells.

Applications

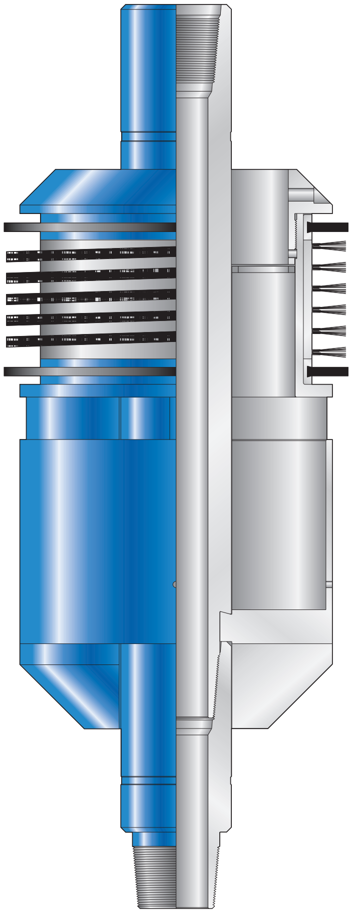
- Deepwater wells

Features and Benefits

- Advanced debris/metal debris cleaning capability with built-in magnets
  - Improves cleaning efficiency
- Non-rotating brushes with 360° coverage
  - Effectively cleans well without damaging or wearing riser wall
- One-piece mandrel design with higher-than-tool-joints tensile and torque ratings
  - Provides a reliable and effective tool to clean wellbores and significantly mitigates completion and production risks and costs
- Highest allowable rotation speed of 150 rpm
  - Increases cleaning efficiency
- No welding on any non-consumable parts
  - Improves operational reliability

The X-Treme Clean™ XP riser brush and boot basket clean the interior casing wall of drilling and production riser systems.

Riser and BOP Cleaning



X-Treme Clean™ EP riser brush and boot basket
Product family no. H13014

EP Riser Brush and Boot Basket

Achieve effective riser cleaning with minimum riser ID wear

The Baker Hughes X-Treme Clean™ EP riser brush and boot basket is designed to clean the inside diameter (ID) area of drilling and production riser systems. It is used to brush and wipe mud residue, cement, or other debris from the riser ID and recover them to surface. The tool can be run for dedicated riser and blowout preventer (BOP) cleaning or as part of the Baker Hughes wellbore cleanup system.

The riser brush and boot basket are built on a full-strength mandrel and are typically run with the Baker Hughes BOP jet sub, X-Treme Clean EP surface junk catcher, or the X-Treme Clean EP multi-task wellbore filter. The nonrotating design allows maximum riser ID cleaning while reducing wear to the riser ID.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP riser brush and boot basket can help you better clean riser IDs.

Application

- Riser cleaning
- Displacement
- Conventional oil and gas
- Deep water
- Wellbore cleanup
- Debris recovery

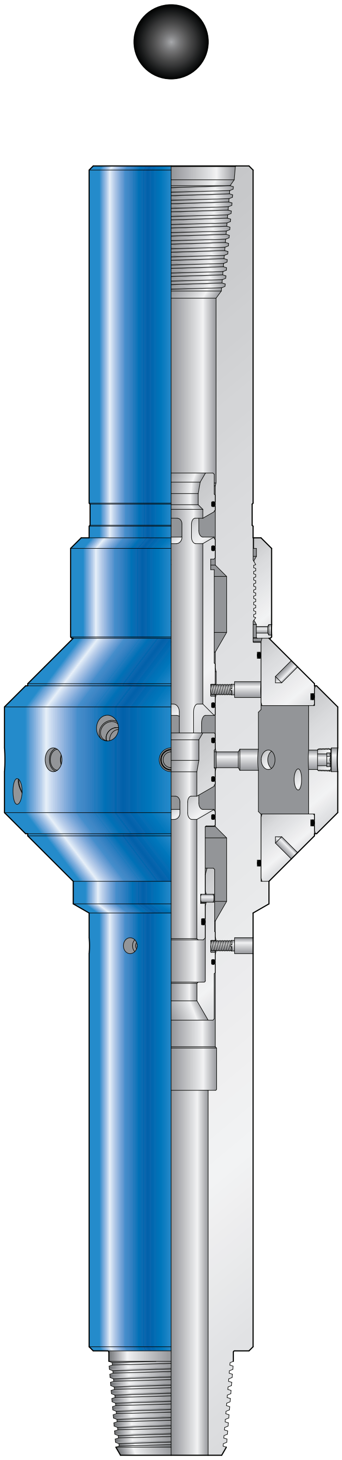
Features and Benefits

- Has built-in boot basket to collect debris
  - Provides better cleaning
- Maintains full drillpipe strength
  - Improves reliability
- Uses nonrotating brushes
  - Reduces riser ID wear
- Provides 360° coverage
  - Improves performance

The X-Treme Clean™ EP riser brush cleans the ID of drilling and production riser systems.

XP Full-Cycle Ball-Activated BOP Jet Sub

Ensure BOP cleanliness while maintaining well control



X-Treme Clean™ XP full-cycle ball-activated BOP jet sub
Product family no. H14088

The Baker Hughes X-Treme Clean™ XP full-cycle ball-activated blowout preventer (BOP) jet sub is used to clean the valves in the BOP through high-rate jetting. It can be run with a wide variety of Baker Hughes tools to perform one-trip well cleanup.

The jet sub uses a dual-piston design adapted from the full function valve. The tool is run into the hole in the closed position, allowing circulation through the bottom of the string. After all other necessary operations are completed, a ball is dropped down the drillstring to the lower piston. Additional pump pressure shears the lower piston, allowing circulation through the side ports and nozzles to the annulus. This function allows for effective cleaning of the BOP stack.

After the BOP jetting operation is performed, a second ball can be dropped to shear the upper piston, sealing the circulation ports and directing all flow through the drillstring below. This allows for enhanced well control by allowing the operator to seal off flow to the annulus at any time during operation. Furthermore, a positive lock feature prevents the sleeve from shifting open in case a well kick does occur.

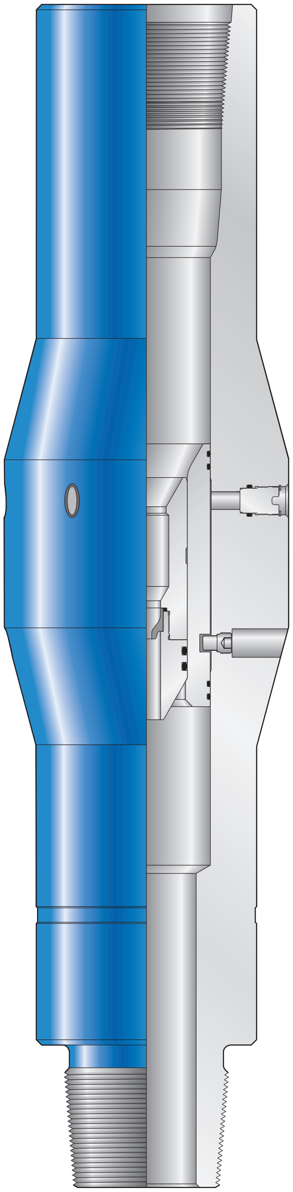
Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to learn how our X-Treme Clean XP full-cycle ball-activated BOP jet sub can ensure BOP cleanliness while maintaining well control.Applications

- Shallow and deep water
- BOP cleaning
- Wellbore cleanup
- Displacement

Features and Benefits

- Dual-piston design
  - Provides full open-close cycle
  - Enhances well control
- One-trip cleaning system
  - Saves time and cost
- Positive lock on upper piston
  - Prevents flow to the annulus if a well kick occurs
- Threaded jet nozzles
  - Add flexibility
  - Simplify maintenance and replacement

Riser and BOP Cleaning



BOP jet sub
Product family no. H14068

EP BOP Jet Sub

Clean blowout preventers effectively

The Baker Hughes blowout preventer (BOP) jet sub is used to clean the valves in the BOP through high-rate jetting. It can be run together with a wide variety of Baker Hughes tools to perform one-trip well cleanup.

The jet sub is run into the hole at closed position, allowing circulation through the bottom. After the other operations are completed, a restriction plug can be dropped from surface into the piston to shift the sleeve open, allowing the wellbore fluid to be pumped through the BOP jet nozzles. A nozzle in the restriction plug will still allow flow through the bottom of the drill string.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the BOP jet sub can help you clean BOP valves more efficiently.

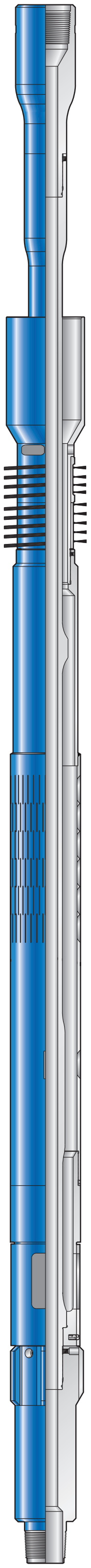
Application

- Deep water
- Conventional oil and gas
- BOP cleaning
- Wellbore cleanup
- Displacement

Features and Benefits

- Simple and robust design
  - Allows reliable and easy operation
- Screw-in jet nozzles can easily be changed
  - Provides flexibility
- Carbide nozzle in restriction plug allows fluid to be pumped at open position to bottom of workstring
  - Increases reliability
- Internal fishneck allows plug to be retrieved by wireline if needed
  - Improves efficiency
- Works with other tools to form one-trip cleaning system
  - Saves time and cost

The BOP jet sub uses high-rate jetting to clean the valves in the BOP stack.



X-Treme Clean™ EP surface junk catcher
Product family no. H13013

EP Surface Junk Catcher

Recover debris during cleaning operations

The Baker Hughes X-Treme Clean™ EP surface junk catcher captures falling debris not circulated out of the hole when riser, blowout preventer (BOP), and wellhead areas are cleaned. It is normally run in a dedicated trip with the BOP jet sub and riser brush. The tool can be used during scheduled BOP tests or when retrieving a wear bushing to prevent debris from being introduced in the wellbore.

The surface junk catcher can be run below the BOP jet sub. Throughout the jetting and cleaning process, any heavier particles of debris that cannot be circulated out of the hole are caught in the integrated boot basket when falling down the hole. A brush assembly with 360° coverage above the boot basket diverts falling debris into the boot. The catcher's large debris capacity is easily extended with minor modifications. Once at surface, the debris can be conveniently removed at rig floor.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes X-Treme Clean EP surface junk catcher helps you capture wellbore debris during cleaning operations.

Application

- Conventional oil and gas
- Deep water
- Displacement
- Wellbore cleanup
- Debris recovery

Features and Benefits

- Large bypass area
  - Allows for fast run-in
- Extensions to basket and mandrel can be added
  - Improves debris-carrying capability
- Large cleanout windows with easy access
  - Allows simple debris-removal operation
  - Reduces nonproductive time
- Uses field-proven Baker Hughes screen/slotted liner technology
  - Increases reliability and improves performance

Notes

Liner Top Test Packers

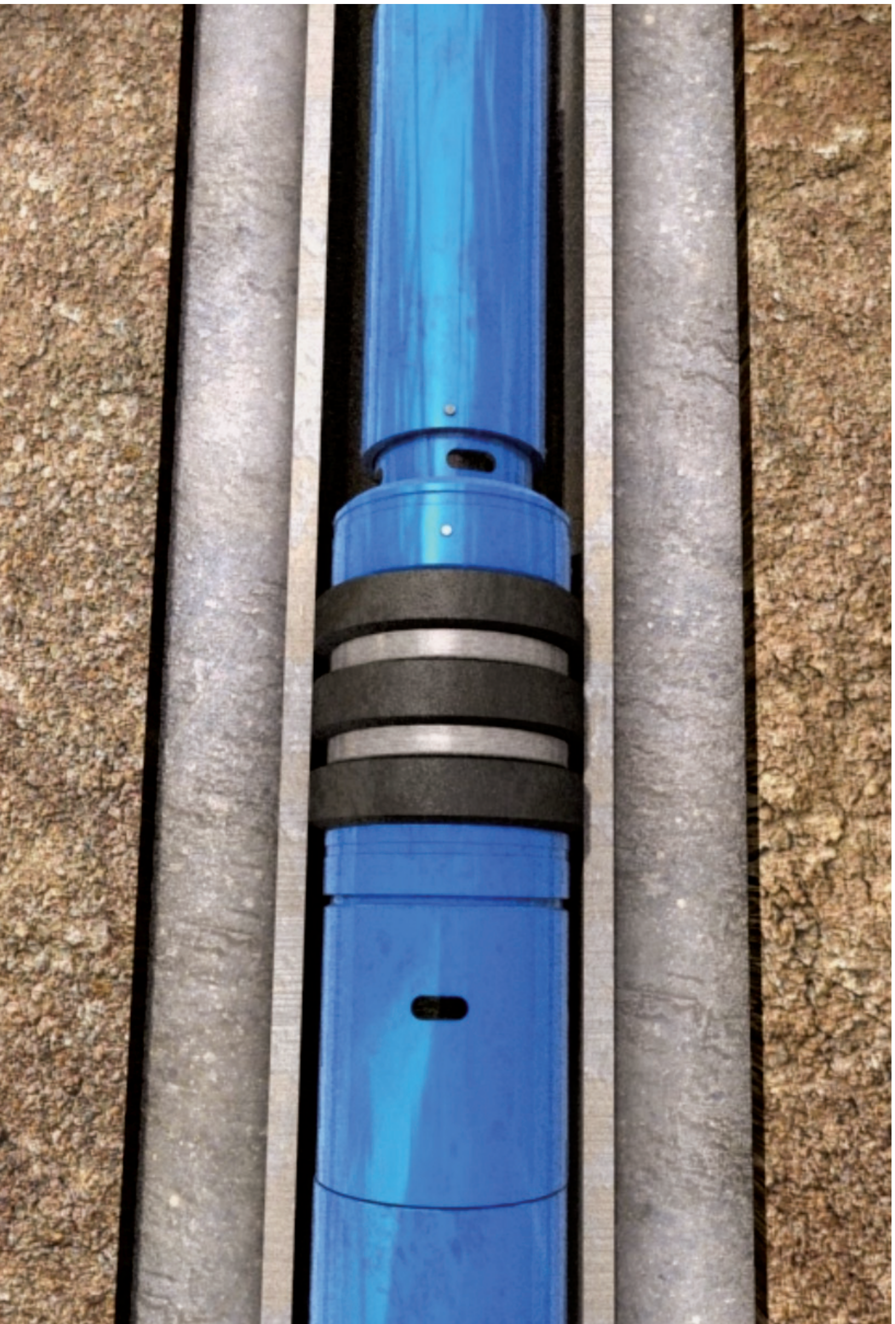
XP Anchoring Test Packer

EP Wellbore Test Packer

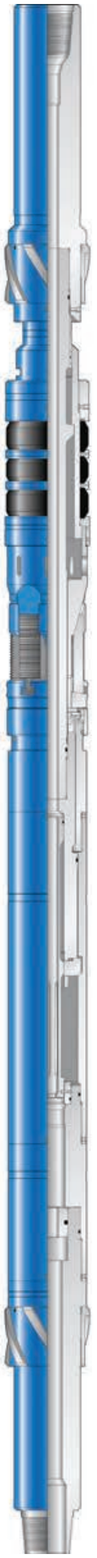
EP Liner Top Test Tool

EP Inflow Test Packer

EP Ball/Dart Catcher Sub



Liner Top Test Packers



X-Treme Clean™ XP anchoring test packer (run-in position)
Product family no. H67242

XP Anchoring Test Packer

Integrate negative inflow testing into your wellbore cleanup operation for improved efficiency

The Baker Hughes X-Treme Clean™ XP anchoring test packer performs negative inflow testing on liner tops in a single trip while it performs wellbore cleanup or displacement operations, eliminating the need for an additional designated run with a retrievable packer.

The tool contains a dual ball-activated safety mechanism to eliminate premature setting prior to the negative inflow test operation. This feature also prevents accidental resetting if the string must be reciprocated following the operation and during displacement work. The test packer is activated via set-down weight and has the ability to be set more than once during a single trip. This allows for an integrity test to be performed prior to the negative inflow test. Typically, the anchoring test packer is run above the liner top dress mill and below a circulation valve.

Slips are integrated into the test packer's design to anchor the system into the casing during the operation. The slips prevent excessive loading to the liner top, which is often seen in the use of standard mechanical test packers. The slips also prevent the elements from moving during the negative inflow test to ensure reliable sealing during the test.

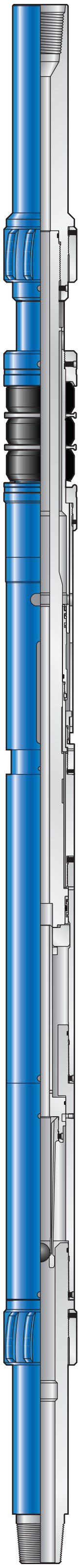
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how our XP anchoring test packer can ensure reliable anchoring and increase efficiency during inflow testing and wellbore cleanup operations.

Applications

- Liner top integrity test with wellbore cleanup or displacement
- Conventional oil and gas
- Deepwater completions
- Deviated wells
- High-temperature wells

Features and Benefits

- Ball-activated safety mechanism
  - Prevents premature setting
  - Allows string reciprocation following negative test
- Large bypass area
  - Allows for rapid deployment
- Single-trip operation with top-dress mill and packer
  - Reduces rig time during completion operations
  - Performs both integrity test and negative test in one run
- Integrated slips
  - Significantly reduce loading into liner top
  - Prevent movement of the elements during negative test
  - Reduce penetration into casing inner diameter



Wellbore test packer
Product family no. H67242

EP Wellbore Test Packer

Perform reliable negative test in same trip as wellbore cleanup operations in deep wells

The Baker Hughes wellbore test packer can perform a negative inflow test on liner tops in the same trip as wellbore cleanup or displacement operations. It eliminates the need for a designated run with a retrievable packer.

The enhanced ball-activated safety mechanism eliminates premature setting in deep and deviated well applications when high compressive loads are applied. The wellbore test packers can be set multiple times in one trip, allowing the packer to be tested and an inflow test to be performed.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes wellbore test packer helps you save operational time and cost.

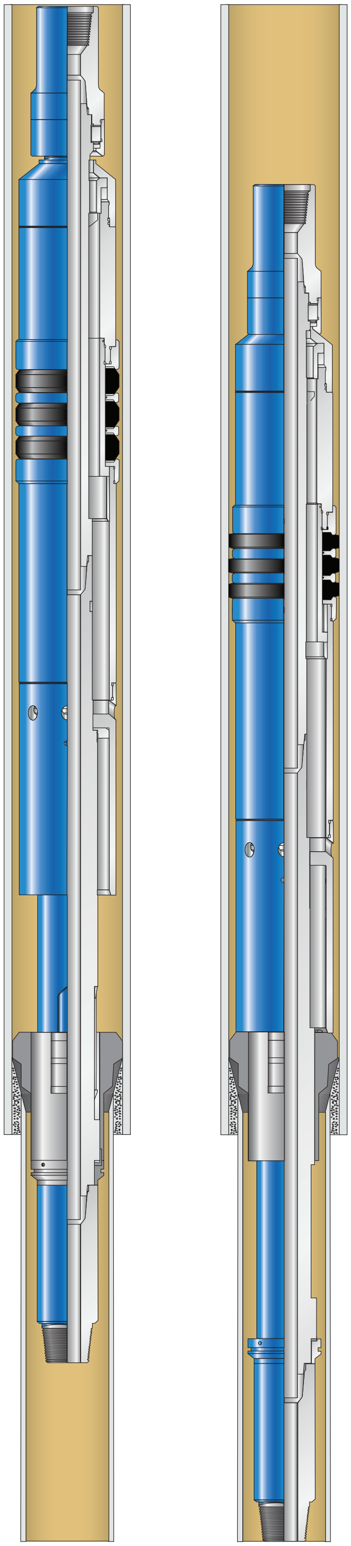
Applications

- Conventional oil and gas
- Deep water
- Deviated wells
- Liner top integrity test with wellbore cleanup or displacement

Features and Benefits

- Allows wellbore cleanup or displacement and liner test to be conducted in a single trip
  - Saves operational time and cost
- Ball-activated safety mechanism
  - Prevents premature setting
- Large bypass area
  - Allows for rapid deployment
- Simple to operate, with multiple resets
  - Reduces operational time
- High torque and tensile capabilities
  - Increases reliability

Liner Top Test Packers



Liner top test tool
Product family no. H16118

EP Liner Top Test Tool

Perform liner top integrity test, displacement, and wellbore cleanup in one trip

The Baker Hughes liner top test tool is designed to dress off and performs an inflow test (negative test) to verify the integrity of the liner top. It can be run in conjunction with other Baker Hughes wellbore cleanup tools to perform liner top testing, displacement, and wellbore cleanup in one trip.

The liner top test tool uses field-proven TST-3 technology for superior sealing. The safety shear settings resist against premature activation, for more accurate and reliable operation. The tool is activated by direct set-down weight. The required low setting force allows it to be used in deep and deviated well applications.

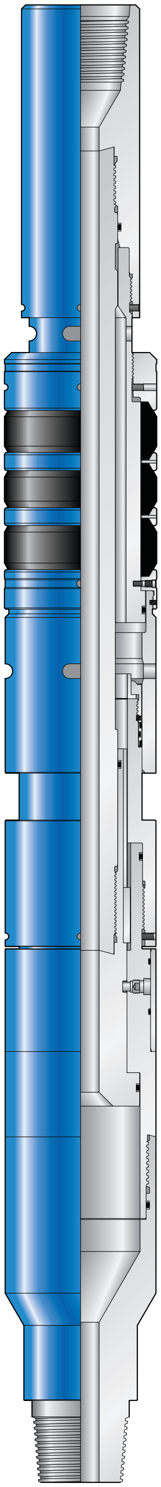
Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the liner top test tool helps you reduce nonproductive time.

Applications

- Displacements
- Wellbore cleanup
- Conventional oil and gas
- Unconventional hydrocarbons
- Deepwater completions
- Extended-reach wells
- Deviated wells
- High-pressure/high-temperature (HP/HT) wells

Features and Benefits

- Single-trip operation with top dress mill and packer
    - Reduces rig time during completion operations
- Adjustable safety shear settings
    - Avoids premature functioning in high-angle holes
- Durable, heavy-duty design
    - Can be used in HP/HT wells
- Can be operated multiple times in a single run
    - Adds flexibility
- Unique internal bypass design
    - Allows high-rate displacements
- Positive liner top location indicator
    - Ensures tool has reached appropriate depth for operation
- Designed to be rotated and reciprocated
    - Can be run in conjunction with Baker Hughes wellbore cleanup tools



Inflow test packer
Product family no. H40723

EP Inflow Test Packer

Perform negative inflow test in same trip as wellbore cleanup operations

The Baker Hughes inflow test packer can perform a negative inflow test on liner tops in the same trip as wellbore cleanup or displacement operations. It eliminates the need for a designated run with a retrievable packer.

The inflow test packers can be set multiple times in one trip, allowing the packer to be tested and an inflow test to be performed. It is usually run on top of the liner top dress mill and below the J-Type™ circulation swivel.

Set-down weight can be applied to activate the packer to perform the packer test. After the packer is successfully tested, lighter fluid is pumped downhole and the negative inflow test is performed.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes inflow test packer helps you save operational time and cost.

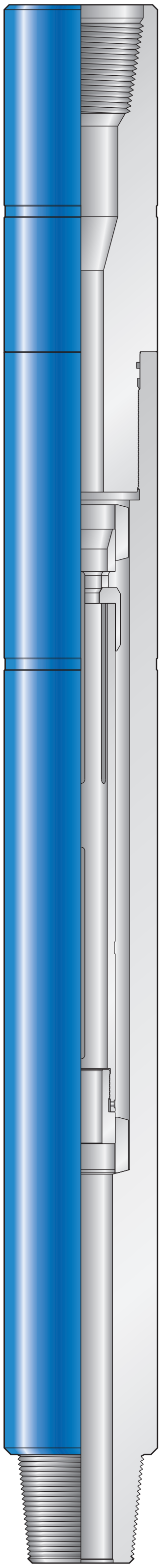
Applications

- Conventional oil and gas
- Liner top integrity test with wellbore cleanup or displacement

Features and Benefits

- Allows wellbore cleanup or displacement and liner test to be conducted in a single trip
  - Saves operational time and cost
- Large bypass area
  - Allows for rapid deployment
- Simple to operate, with multiple resets
  - Reduces operational time
- High torque and tensile capabilities
  - Increases reliability

Liner Top Test Packers



Ball/dart catcher sub
Product family no. H14077

EP Ball/Dart Catcher Sub

Catch darts or balls while allowing full flow

The Baker Hughes ball/dart catcher sub is used to catch balls or darts that have been released from tools such as dart-activated circulation subs and wellbore test packers to prevent the balls or darts from being left in the hole. The ball or dart catcher is available in several sizes and works with a variety of tools.

Sufficient bypass is built into the tool to allow full flow around the balls or darts after they are retained in the inner sleeve. This inner sleeve has a reverse-flow stop near the upper end to retain balls or darts in the event of reverse circulation.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/wbcu to find out how the Baker Hughes ball/dart catcher sub can help you capture balls or darts.

Applications

- Conventional oil and gas
- Unconventional hydrocarbons
- Deep water

Features and Benefits

- Configurable for either balls or darts
  - Provides flexibility
- Can be run as part of a complete wellbore cleanup system
  - Saves time
- Internal collet in catcher prevents darts and balls from flowing upward
  - Reduces risks

VACS Portfolio

Baker Hughes VACS Technology

VACS Debris Basket

VACS G2 System

VACS FLO System

VACS Junk Catcher

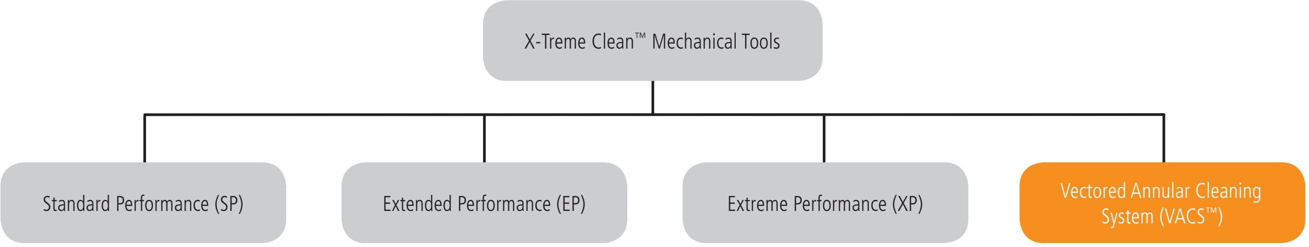
BAKER HUGHES

Baker Hughes VACS Technology

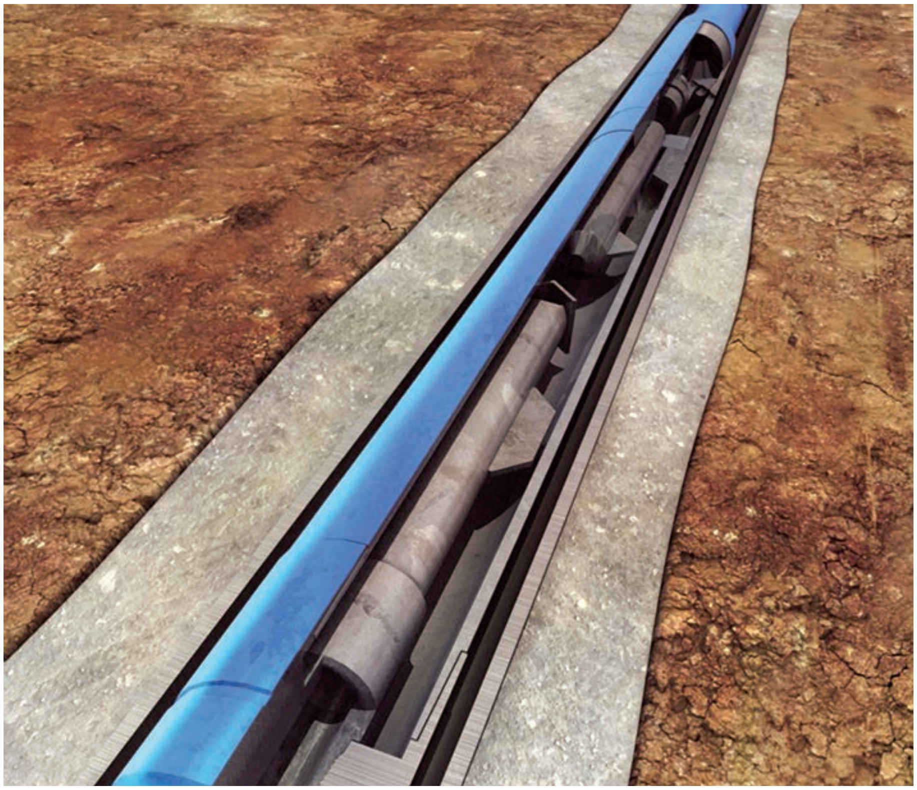
Baker Hughes vectored annular cleaning system (VACS™) technology has been applied in field operations for more than a decade. The system collects debris downhole, eliminating the need for bottoms up circulation, and protecting debris sensitive surface equipment. It is especially useful in wells with low fluid levels, fluids with low carrying capability or low fracture gradient, or deviated and deep wells.

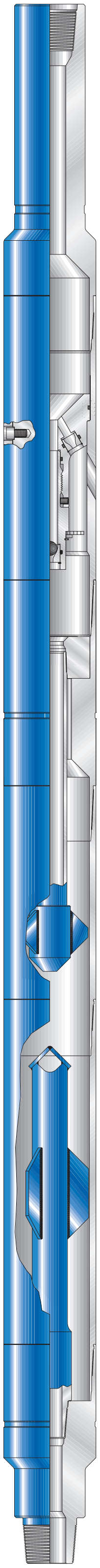
Following a long and successful run history with VACS, we launched an improved modular system—VACS G2. The system has been optimized for easier rig handling and improved debris separation to provide maximum performance and increased efficiency.

The latest addition to the VACS portfolio is our VACS FLO™ system, which is based on the modular design of our VACS G2 system. The new system integrates dual flow paths to allow wellbore cleaning and integrity testing operations in a single trip. Combined with the advanced VACSPredictor™ simulation tool, Baker Hughes VACS technology provides the industry's most reliable and efficient debris removal solutions.


X-Treme Clean™ Mechanical Tools
Standard Performance (SP)
Extended Performance (EP)
Extreme Performance (XP)
Vectored Annular Cleaning System (VACS™)

Please refer to Sections11-15 for more information about our SP, EP, and XP tools.





VACS™ debris basket
Product family no. H13125

VACS Debris Basket

Capture debris downhole in one trip for reduced NPT

The Baker Hughes vectored annular cleaning system (VACS™) debris basket captures debris downhole. It can be used in a variety of applications such as post-perforation sump packer cleaning, one-trip packer milling, and one-trip plug and packer retrieving. VACS technology has an outstanding record of success in saving time and costs through more than a decade of use in wellbore cleanup (WBCU) and fishing operations.

The VACS debris basket consists of a jet bushing, a drive sub, several joints of washpipe, triple-connection bushing, Baker Hughes screen joints and bushing, and a diverter tube and cap. As conventional circulation pushes fluid through the jet nozzles, the VACS system produces a suction pressure at the base of the debris basket. This induced pressure differential pulls any debris from the well into the debris basket.

The VACS debris basket is ideal for keeping small debris from accumulating inside a subsea blowout preventer stack, reaching surface where it can damage rig equipment, or becoming suspended in fluids. The VACS system requires low pump rate, minimizing impact to the formation.

Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to find out how our VACS debris basket captures small debris downhole in one trip for reduced noproductive time (NPT).

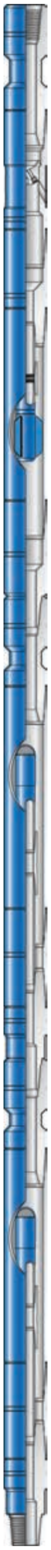
Applications

- Vertical, deviated, and horizontal wells
- Shallow or deep wells
- Deep water
- High-pressure/high-temperature environments
- Wells with partial or total lost circulation
- Wells with fluids exhibiting poor debris-carrying capability
- Wells with weak formations

Features and Benefits

- Powerful jet bushing
  - Creates reverse circulation to facilitate debris collection
- Washpipe
  - Forms debris chamber
  - Can be added to increase debris-carrying capacity
- Engineered diverter cap
  - Deflects debris into debris chamber
  - Prevents fine debris from reaching the screen

VACS Portfolio



VACS™ G2 system
Product family no. H13126
H13126 (jet engine module)
H13127 (debris retainer module)

VACS G2 System

Reduce NPT and HSE risk while increasing efficiency

The Baker Hughes vectored annular cleaning system (VACS™) G2 captures debris located at the well bottom, or that was generated during well operations. Built on field-proven VACS technology that has gained a solid reputation over more than a decade, this new modular design offers enhanced performance and ease of handling, saving time and lowering risk, particularly in deepwater applications.

As fluid flows through the jet nozzles, the VACS G2 jet engine design produces increased suction pressure at the base of the tool, pulling in any fine or big debris or junk from the well into the tool basket. The VACS G2 engine has been optimized to provide increased reliability and performance during a variety of operations, including post perforating and sump packer cleaning, packer plug or bridge plug retrieval, and junk retrieval for openhole or cased hole.

Other improvements in the G2 version of the VACS system include significant changes to the rig handling procedures. Each module can be manipulated by standard rig elevators, removing the need for on-site assembly or any specialized equipment. These simplified handling processes eliminate many potential operational and health, safety, and environmental (HSE) risks, and the modular design also reduces nonproductive time (NPT) by eliminating special rigging requirements. Modules can easily be added for increased debris recovery.

The new VACS G2 system is ideal for deepwater applications where minimizing NPT and improving operational reliability is essential to profitability. This system has been field-tested and validated, with results clearly indicating the tool's increased performance and efficiency. Incorporating Baker Hughes VACS technology, including the modular VACS G2 system, into your operations ensures that you receive the most reliable and cost-efficient solution for your reservoir.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/vacsg2 to find out how the modular design of our VACS G2 system reduces NPT and increases efficiency.

The VACS™ G2 system contains an optimized fluid diverter for enhanced debris collection and increased reliability.

VACS Portfolio

Applications

- Vertical, deviated, and horizontal wells
- Shallow or deep wells
- Deep water
- High-pressure/high-temperature environments
- Wells with partial or total lost circulation
- Wells with fluids with poor debris-carrying capability
- Wells with weak formations

Features and Benefits

- Modular design
  - Reduces NPT by eliminating special rigging requirements
  - Reduces HSE risks
  - Adapts for varying debris capacities
- Improved jet engine design
  - Increases suction pressure
  - Reduces the likelihood of plugging
- Improved debris-retaining modules
  - Increases efficiency of debris separation
  - Lessens the probability of debris reaching the screen, increasing reliability

VACS technology allows for the capture of debris downhole, making it an ideal candidate for applications such as sump packer cleaning, packer milling, and plug retrieval.

VACS Portfolio

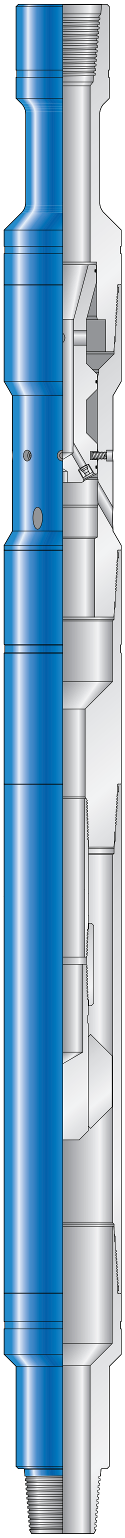
VACS FLO System

Perform cleanup and wellbore integrity testing operations in a single trip

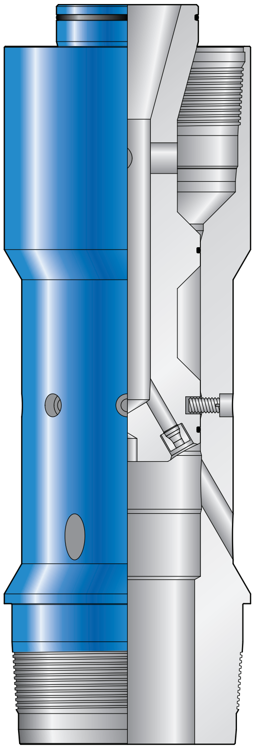
The Baker Hughes VACS FLO™ system is one of the latest additions to our field-proven vectored annular cleaning system (VACS™) portfolio. Built on our VACS G2 system design, the new system integrates dual flow paths to allow wellbore cleaning and integrity testing operations in a single trip. The tool's design allows it to be configured for reverse circulation or conventional circulation as needed for maximum operational efficiency.

During run-in, the VACS FLO system is configured as a standard VACS system. As fluid flows through the jet nozzles, the tool induces a reverse-circulation flow loop downhole, pulling debris from the well bottom or debris generated during well operations into the tool's internal basket. The VACS FLO jet sub is optimized to provide increased reliability and performance during a variety of operations, specifically post-perforating and sump packer cleaning.

If conventional circulation is desired, or if pressure needs to be applied below the VACS FLO jet sub, a ball is dropped and surface pressure is applied. The VACS FLO system is rated to 5,000 psi (344.7 bar) to allow application of pressure below the tool. In this configuration, all flow is directed through the tool to the bottom of the workstring.



VACS FLO System
Product family nos.
H13126 (jet engine),
H13127 (debris retainer)



VACS FLO jet sub
Product family no. H13096

Using its dual flow design, the VACS FLO system can remove debris from the wellbore prior to performing high-rate circulation or tubing tests without the need for a secondary run. When combined with other Baker Hughes wellbore cleanup tools, the system can also perform sump packer cleaning and tubing/casing shoe integrity tests in one run. By identifying and managing leaks, and ensuring a clean wellbore prior to installation of the completion, operators can mitigate risk and keep costs down in increasingly complex deepwater operations.

With more than a decade of successful operations using our comprehensive portfolio of VACS products, Baker Hughes can provide a timely, reliable, and cost-effective solution to meet the needs of your reservoir.

Contact your Baker Hughes representative today or visit www.bakerhughes.com/WBCU to find out how our VACS FLO system can maximize efficiency by performing wellbore cleanup and wellbore integrity testing operations in a single run.

VACS Portfolio

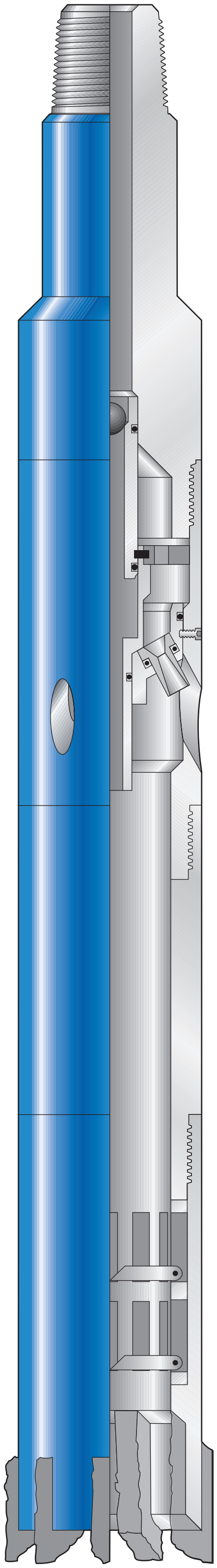
Application

- Vertical, deviated, and horizontal wells
- Shallow or deep wells
- Deep water
- HP/HT environments
- Wells with partial or total lost circulation
- Wells with fluids that have poor debris-carrying capability
- One-trip sump packer and tubing/casing shoe integrity testing
- One-trip debris cleaning and high-rate flow or integrity testing

Features and Benefits

- Single ball-activated piston design
  - Allows flow path to be converted from reverse circulation to conventional circulation
- Modular design
  - Adapts for varying debris capacities
  - Based on existing, field-proven VACS G2 system design
  - Reduces nonproductive time and health, safety, and environmental risks by eliminating special rigging requirements
- High-pressure rating and large bypass area
  - Allows for downhole integrity testing and high-rate circulation

VACS Portfolio



VACS™ junk catcher
Product family no. H13097

VACS Junk Catcher

Effectively recover large junk from the well bottom with high-power system

The Baker Hughes vectored annular cleaning system (VACS™) junk catcher is extremely powerful in large junk or debris retrieval or fishing operations involving bit cones, chains, tools, and other large objects. The field-proven Baker Hughes VACS portfolio has demonstrated reliability through more than a decade of successful operations.

The VACS junk catcher operates on the principle of convective acceleration to recover junk from the well bottom. Fluid exiting the ports of the jet bushing creates suction at the base of the tool, pulling in any loose debris from the well bottom into the debris chamber, where it is held by the tool's junk catchers. An optional ball-drop feature allows circulation through the tool to clean the top of the fish before reverse circulation is begun.

The VACS junk catcher is placed at the bottom of the workstring. The one-directional finger catcher design ensures that large junk is fully secured in the tool until disassembly. The junk catcher can be used with other Baker Hughes tools such as magnets and circulation subs to enhance operations in fishing and wellbore cleanup applications. It requires low pump rate, minimizing impact to the formation.

Contact your Baker Hughes representative or visit www.bakerhughes.com/wbcu to find out how our high-power VACS junk catcher can help you effectively recover large junk from the well bottom.

Applications

- Vertical, deviated, and horizontal wells
- Shallow or deep wells
- Openhole or cased hole
- Deep water
- High-pressure/high-temperature environments
- Debris recovery
- Junk retrieval
- Fishing

Features and Benefits

- Powerful jet bushing
  - Creates reverse circulation for optimal debris removal
- Flexible system
  - Allows for adaptability during operation
- Washpipe connections at jet bushing
  - Allow for tool extension
- Optional ball-drop feature
  - Allows for circulation through tool before engaging jetting function
- Simple, efficient design
  - Covers nearly all casing and hole sizes
  - Operates with simple procedures for added reliability
  - Allows for quick assembly and disassembly
  - Minimizes maintenance requirements

Engineered Solutions

VACSPREdictor Advanced Simulation Model

Advantage Torque and Drag Engineering Application

DISPLEX Advanced Displacement Simulation Model

HES Retrieving Tool - VACSPredictor
Calculate
Help
Units: English
Analysis
Velocity Chart
Pressure Drop Chart
Pressure Profile Chart
Lines and Colors
Pressure Chart
Tubing Pressure
Annular Pressure
Measured Depth (ft) (10^3)
Pressure (psi) (10^3)
South Timbalier 135
Chevron
W-9 BP 01
Packer Plugs and Bridges Plug Retrieval

VACSPREdictor Advanced Simulation Model

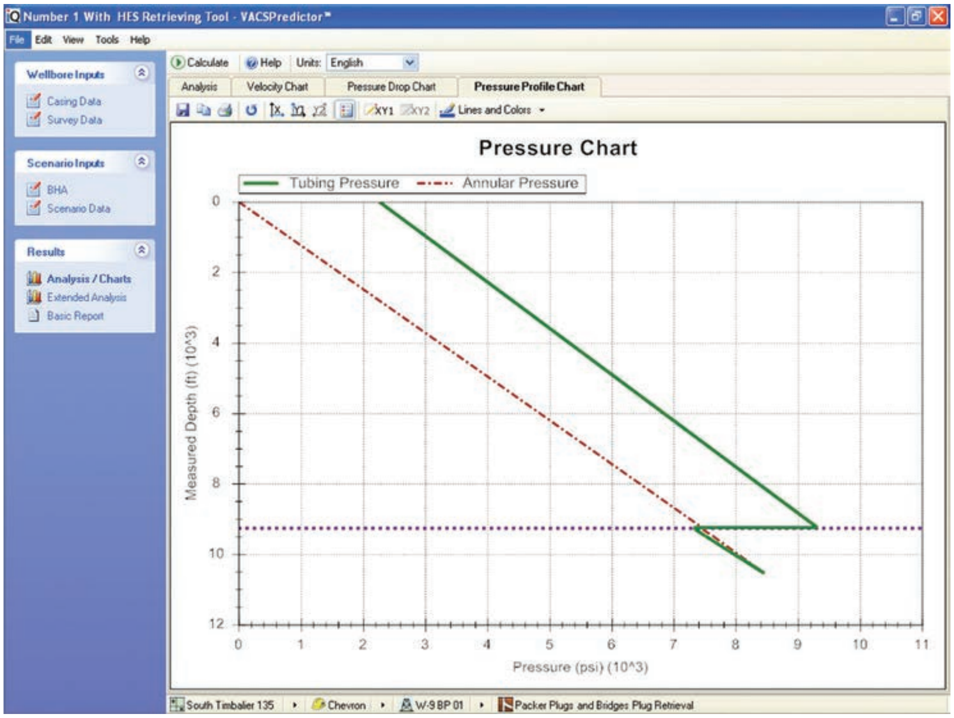
Design, evaluate, and optimize VACS operations

VACSPREdictor™ software is prejob planning software that provides guidance to vectored annular cleaning system (VACS™) applications. It is based on a robust and reliable mathematical model that has been proven by the field-test data.

The VACSPREdictor program is used in the planning stage to identify and understand the potential issues and challenges, such as ensuring the downhole pressure is below the fracturing pressure and the debris are effectively collected, and provide the optimized operation solution.

The software provides pressure and flow rate profiles from the surface to downhole, and assists in determining the operational condition to clean up the debris in the well. A complete analysis report, including the well information, bottomhole assembly information, and well conditions including pressure and flow rate, is generated. These profiles are provided through data as well as in charts that can be quickly generated and ready to present.

The VACSPREdictor program has been field-tested and validated, and the results have shown excellent agreement with data obtained in real time. Contact your Baker Hughes representative today or visit www.bakerhughes.com/vacs to learn more about how it can optimize your operation.


Number 1 With HES Retrieving Tool - VACSPredictor™
File
Edit
View
Tools
Help
Wellbore Inputs
Casing Data
Survey Data
Scenario Inputs
BHA
Scenario Data
Results
Analysis / Charts
Extended Analysis
Basic Report
Calculate
Help
Analysis
Velocity Chart
Pressure Drop Chart
Pressure Profile Chart
XY1
XY2
Lines and Colors
Pressure Chart
Tubing Pressure
Annular Pressure
Measured Depth (ft) (10^3)
0
2
4
6
8
10
12
0
1
2
3
4
5
6
7
8
9
10
11
Pressure (psi) (10^3)
South Timbalier 135
Chevron
W-9 BP 01
Packer Plugs and Bridges Plug Retrieval

Units: English

VACSPREdictor™ advanced simulation model

Applications

- Use with any VACS technology applications, including
  - General debris cleaning in cased holes or open holes
  - Post perforation and sump packer cleaning
  - Packer plug or bridge plug retrieval
  - Permanent packer, bridge plug, or cement retainer milling

Features and Benefits

- Prejob planning software
  - Determines best solution for each well to improve wellbore cleanup
  - Provides added reassurance to operators
- Software provides downhole pressure and flow rate profiles
  - Ensures downhole pressure is below fracturing pressure
  - Assists in defining optimized operational window
- Field-tested and validated Microsoft Windows-based* engineering software
  - Offers reliable solution
- Simple report creation
  - Saves time

Advantage Torque and Drag Engineering Application

Accurately calculate forces and stresses on tubular strings

The Advantage™ torque and drag engineering application analyzes the forces and stresses on tubular strings, accurately calculating complex mechanical force interactions generated down hole. Calculation modes are provided for six distinctly different problem-solving architectures.

The Torque and Drag Calculation mode provides complete surface-to-bit load, stress and contact load information for rotary or non-rotary drilling operations at a user-specific measured depth.

The Weight-on-Bit Calculation mode enables direct evaluation of drill bit or other downhole tool loading for coiled tubing and other drilling or non-drilling applications.

The Friction Factor Calculation mode allows analytical inference of case and open-hole drillstring/wellbore friction factors from observed hookload or rotary torque data.

The Bit Drag and Overpull Force Calculation mode determines bit overpull and bit drag forces when corresponding observed surface loads and friction factors along the well path are specified.

The Depth In/Depth Out Calculation mode provides a means for evaluating key drillstring operating loads and casing-wall thickness attrition when drilling a user-specified interval.

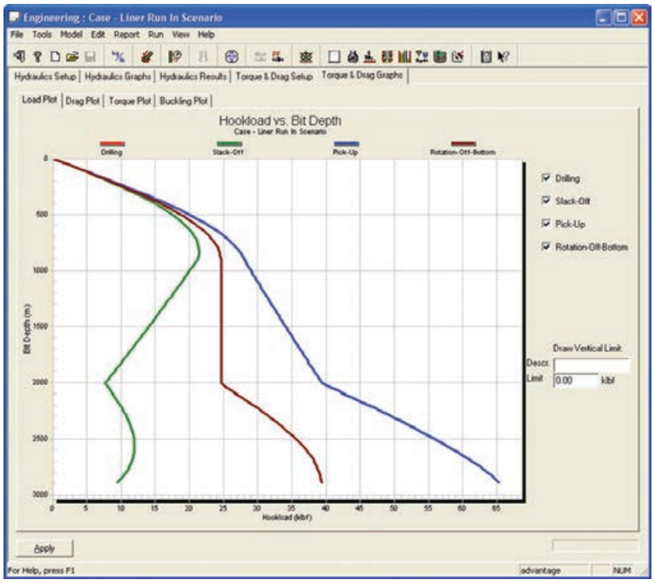
The Stuck Point Calculation mode enables you to estimate where a string got stuck, based on either hookload and elongation inputs or surface torque and twist.

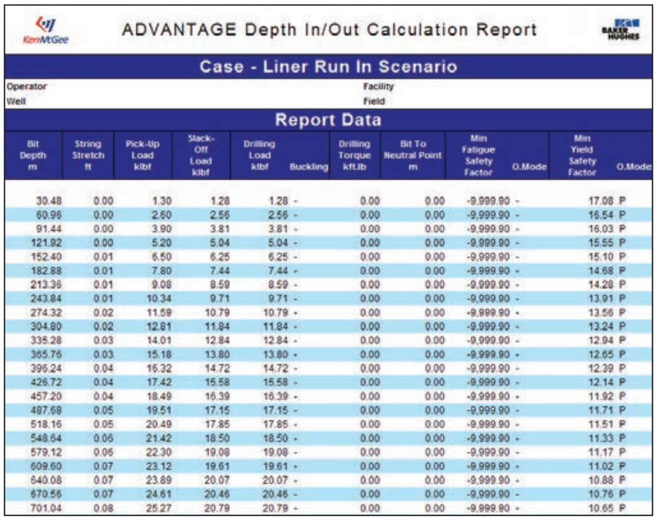
Applications

- Tubular string force and stress analysis

Features and Benefits

- Provides six different problem-solving architectures
  - Facilitates well development by allowing complex mechanical forces generated downhole to be precisely calculated


Engineering : Case - Liner Run In Scenario
File Tools Model Edit Report Run View Help
Hydraulics Setup | Hydraulics Graphs | Hydraulics Results | Torque & Drag Setup | Torque & Drag Graphs
Load Plot | Drag Plot | Torque Plot | Buckling Plot
Hookload vs. Bit Depth
Case - Liner Run In Scenario
Drilling
Slack-Off
Pick-Up
Rotation-Off-Bottom
0
500
1000
1500
2000
2500
3000
Bit Depth (m)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Hookload (klbf)
☑ Drilling
☑ Slack-Off
☑ Pick-Up
☑ Rotation-Off-Bottom
Draw Vertical Limit
Desc.
Limit 0.00 klbf
Apply
For Help, press F1
advantage
NUM



ADVANTAGE Depth In/Out Calculation Report

Case - Liner Run In Scenario

Operator

Well

Facility

Field

Report Data

Bit Depth m	String Stretch ft	Pick-Up Load klbf	Slack-Off Load klbf	Drilling Load klbf	Buckling	Drilling Torque kft.lb	Bit To Neutral Point m	Min Fatigue Safety Factor	O.Mode	Min Yield Safety Factor	O.Mode
30.48	0.00	1.30	1.28	1.28	-	0.00	0.00	-9,999.90	-	17.08	P
60.96	0.00	2.60	2.56	2.56	-	0.00	0.00	-9,999.90	-	16.54	P
91.44	0.00	3.90	3.81	3.81	-	0.00	0.00	-9,999.90	-	16.03	P
121.92	0.00	5.20	5.04	5.04	-	0.00	0.00	-9,999.90	-	15.55	P
152.40	0.01	6.50	6.25	6.25	-	0.00	0.00	-9,999.90	-	15.10	P
182.88	0.01	7.80	7.44	7.44	-	0.00	0.00	-9,999.90	-	14.68	P
213.36	0.01	9.08	8.59	8.59	-	0.00	0.00	-9,999.90	-	14.28	P
243.84	0.01	10.34	9.71	9.71	-	0.00	0.00	-9,999.90	-	13.91	P
274.32	0.02	11.59	10.79	10.79	-	0.00	0.00	-9,999.90	-	13.56	P
304.80	0.02	12.81	11.84	11.84	-	0.00	0.00	-9,999.90	-	13.24	P
335.28	0.03	14.01	12.84	12.84	-	0.00	0.00	-9,999.90	-	12.94	P
365.76	0.03	15.18	13.80	13.80	-	0.00	0.00	-9,999.90	-	12.65	P
396.24	0.04	16.32	14.72	14.72	-	0.00	0.00	-9,999.90	-	12.39	P
426.72	0.04	17.42	15.58	15.58	-	0.00	0.00	-9,999.90	-	12.14	P
457.20	0.04	18.49	16.39	16.39	-	0.00	0.00	-9,999.90	-	11.92	P
487.68	0.05	19.51	17.15	17.15	-	0.00	0.00	-9,999.90	-	11.71	P
518.16	0.05	20.49	17.85	17.85	-	0.00	0.00	-9,999.90	-	11.51	P
548.64	0.06	21.42	18.50	18.50	-	0.00	0.00	-9,999.90	-	11.33	P
579.12	0.06	22.30	19.08	19.08	-	0.00	0.00	-9,999.90	-	11.17	P
609.60	0.07	23.12	19.61	19.61	-	0.00	0.00	-9,999.90	-	11.02	P
640.08	0.07	23.89	20.07	20.07	-	0.00	0.00	-9,999.90	-	10.88	P
670.56	0.07	24.61	20.46	20.46	-	0.00	0.00	-9,999.90	-	10.76	P
701.04	0.08	25.27	20.79	20.79	-	0.00	0.00	-9,999.90	-	10.65	P

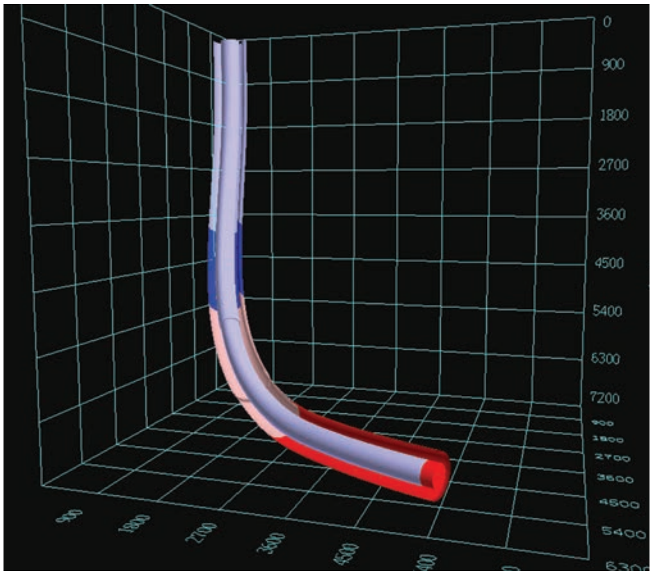
DISPLEX Advanced Displacement Simulation Model

Improve removal of drilling fluid, residue, and debris during wellbore displacements

The DISPLEX™ advanced displacement simulation model provides an effective link between drilling fluids, drill-in fluid and completions operations. It also facilitates the safe and effective removal of drilling fluid and damaging residue and debris from wellbores during the construction of high-rate, high-productivity wells, including those in deepwater. DISPLEX is also an excellent planning tool that assists in managing rig time, selecting pill volumes, minimizing spacer interfacing, controlling filtration costs, and delivering cleaner wellbores in open-hole completions.

Proprietary DISPLEX software works by modeling the displacement of drilling and completion fluids. These simulations identify potential problems during a well's planning phase, providing the completion fluid engineer with a convenient tool to make appropriate modifications before pumping starts. Capabilities include:

- Determining fluid displacement flow dynamics in 3D wells
- Visualizing survey data and 3D well paths
- Importing survey data from text (ASCII) or PDF files
- Modeling forward or reverse circulation
- Provides time and pressure report of all fluids and spacers during displacement
- Calculating free-fall and back-filling (U-tubing)
- Deepwater capabilities that allow for choke, kill, and boost line in the displacement
- Performing circulation sub and flow bypass simulations
- Calculating equivalent circulating density and pressures at various depths versus time
- Projecting pipe eccentricities
- Creating cleanup tool visualizations
- Visualizing fluid displacement/flow-patterns



The DISPLEX engineering model facilitates the safe removal of mud and damaging debris from wellbores by identifying potential problems during the planning phase.

Applications

- High-rate, high-productivity wells
- All deepwater projects
- Open-hole applications

Features and Benefits

- Provides an effective link between drilling fluids, drill-in fluid and completion operations in high-rate, high-productivity wells, including those in deepwater
  - Facilitates safe and effective removal of drilling fluid and damaging residue and debris from wellbores
- Improves open-hole completion planning
  - Assists in managing rig time, selecting pill volumes, minimizing spacer interfacing, controlling filtration costs, and delivering cleaner wellbores
- Capable of simulating both direct and indirect displacements for both synthetic/oil- and water-based drilling fluids
  - Supports proper planning for any type of displacement
- Identifies potential problems during the well planning phase
  - Enables the fluid engineer to make appropriate changes before pumping starts

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